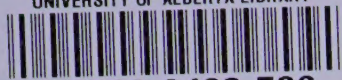


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CURRICULUM

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JUNIOR HIGH MATHEMATICS CONSORTIUM

TEACHER'S RESOURCE BOOK

LEVEL SEVEN

Unit IV Rate, Ratio & Percent

Unit V Measurement

Unit VI Exponents

Unit VII Geometry

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Junior High Mathematics Consortium, 1976

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JUNIOR HIGH MATHEMATICS CONSORTIUM

MATHEMATICS PROGRAM

This Junior High Mathematics Program has been prepared through the cooperative efforts of the twenty member systems in the Junior High Mathematics Consortium. All the components of the program are related to performance objectives and provide the teacher with a variety of teaching strategies, activities and resources to facilitate the instructional process. The teachers have the opportunity to determine the modes of instruction that best suits them and their students.

For each objective within the program, there is a bank of test items. The items in the bank have been field tested to determine difficulty and reliability and validated by a committee of teachers and curricular coordinators.

The program was made possible through the assistance and cooperation of many individuals. Special thanks and acknowledgments are extended to:

the many teachers who helped design, develop, pilot and revise the program materials;

the publishers for referencing their materials to the performance objectives: Addison-Wesley, Gage Publishing and Holt Rinehart;

the Department of Education, Province of Alberta for partially funding the project;

the administrators, supervisors, consultants and curricular associates from each of the cooperating systems for providing time, money and expertise to the program.

2698139

ACKNOWLEDGEMENTS

The components of this program have been developed by teachers from the following school systems:

1. Edmonton Public School District #7
2. Edmonton Separate School District #7
3. County of Leduc #25
4. County of Parkland #31
5. St. Albert Protestant Separate School District #6
6. County of Strathcona #20
7. Calgary School District #19
8. Calgary Roman Catholic Separate School District #1
9. Foothills School Division #38
10. County of Vulcan #2
11. County of Ponoka #3
12. Red Deer School District #104
13. Red Deer Roman Catholic Separate School District #17
14. Mountain View County #17
15. Falher Consolidated School District #69
16. Fort McMurray Roman Catholic Separate School District #32
17. Bonnyville School Division #46
18. County of Beaver #9
19. County of St. Paul #19
20. St. Paul School District #2228

ACTIVITIES

LEVEL 7

UNIT IV

RATE, RATIO AND PERCENT

Percent Pairs

PURPOSE: To provide practice in converting fractions to percent and percent to fractions.

MATERIALS: 2 decks of 40 cards each

- fractional number cards (may include equivalent fractions)
- percent number cards (equivalent to fractional number cards)

RULES:

1. 2 - 4 players.
2. Each player is dealt five fraction cards.
3. The player to the left of the dealer begins play by turning up one card from the deck of cards containing the percent numbers. All players then convert the percent to a fraction and the player having the correct fraction card claims the percent card and places the fraction card and percent card as a pair.

If no player has the correct fraction card, the percent card is returned to the bottom of the deck and the next player turns up the next percent card.

Players making a pair must keep 5 cards in their hand by drawing from the remainder of the fraction card deck.

Play continues until one player has achieved eight pairs.

NOTE:

1. A time limit of one minute may be set (depending on the ability of the student) for each turn.
2. The game may be set for varying numbers as to who constitutes the winner. e.g. 5 pairs.
3. This game could be reversed for concept of changing fractions to percent, or could be adapted to changing fractions to decimals, or decimals to fractions.

APPLICATIONS

LEVEL 7

UNIT IV

RATE, RATIO & PERCENT

BIBLIOGRAPHY FOR APPLICATIONS KIT

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- Stein, Practical Applications in Mathematics, Allyn and Bacon Inc., Boston, 1972
- Witherding, Margaret F., From Fingers to Computers, Franklin Publications Inc. Chicago, 1970

VIDEO TAPES

ETV Math Series produced in Ontario Tape #1 Part D

Approximating & Estimations

Good for Grade 8 Measurement Applications

Tape #3 Part B

So You Want to Buy a Car

(Application in credit buying Grade 9 level)

Tape #5 Part A

Art from Computers

Useful as maxirational unit for applying Math to Art any grade level.

OBJECTIVESRATE, RATIO, AND PERCENT

Students should be able to:

1. Maintain previously developed skills and ideas:
change fractions to an equivalent fraction whose denominator is 100.

2. Express rates, and ratios, in the form $\frac{a}{b}$.

3. Find the missing component in any rate or ratio expressed in the equivalence condition form.

e.g. $\left(\frac{3}{5} = \frac{x}{20} \right)$

A, E

4. Solve problems involving rates and ratio.

B, C, D, F

- *5. Convert fractions to percent.

- *6. Convert percent to fractions.

- *7. Convert decimals to percent.

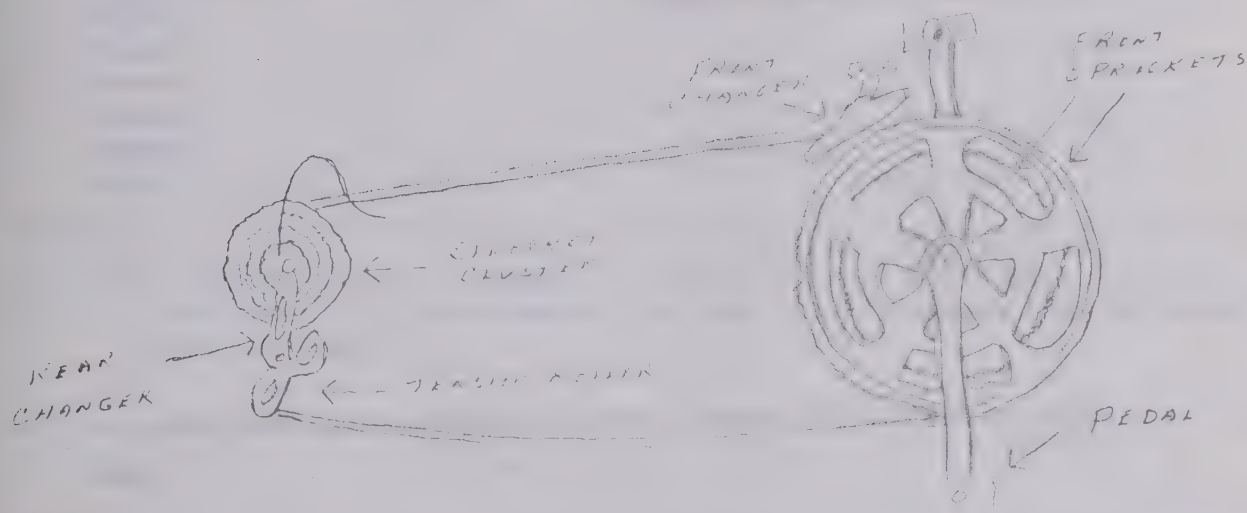
- *8. Convert percent to decimals.

- *9. Solve problems involving percent.

F, K

B.

1. Gears on cars, clocks and bicycles are examples of the importance of ratios. A ten-speed bicycle is easy to study since the gears are visible and can be easily examined. On one model of ten-speeds, the following data was recorded.



Sprocket Cluster		Front Sprockets
Number of	30	48
Cogs (Teeth)	24	40
	20	
	17	
	14	

Wheel measures: Diameter = 70 cm
 Circumference = 220 cm

You could use the data provided or record the same data for your bike to complete the following questions.

- (a) First gear is the slowest and is obtained when the chain is around the smallest front sprocket and the largest rear sprocket, i.e., 40 cogs in front and 30 cogs at the rear. How would you cut second gear? Tenth gear?

RATE, RATIO AND PERCENT

A. Rate Pairs

1. If the driver's reaction time before applying his brakes is one second, how many metres will the car go in one second at each of the following speeds:

- (a) 70 km/h
- (b) 60 km/h
- (c) 100 km/h
- (d) 80 km/h
- (e) 110 km/h

Using an Operator's Manual, compare braking distances with the above.

Complete the following chart for each of the gears.

Gear	No. of Cogs on Front Sprocket	No. of Cogs on Rear Sprocket
First	40	30
Second		
Third		
Fourth		
Fifth		
Sixth		
Seventh		
Eighth		
Ninth		
Tenth	48	14

- (b) In first gear, one complete rotation of the pedals will produce 40/30 or $1\frac{1}{3}$ rotations of the rear wheel. Record this information for each gear.

Gear	1	2	3	4	5	6	7	8	9	10
1 Pedal Rotation Yields ____ Turns	$1\frac{1}{3}$									$3\frac{3}{7}$

- (c) When you are in first gear, one rotation of the pedals yields $1\frac{1}{3}$ turns of the rear wheel. Since the rear wheel is 220 cm in circumference, each rotation of the pedal will cause you to go forward $1\frac{1}{3} \times 220$ or 293- $\frac{1}{3}$ cm.

Record the distance one rotation of the pedals will carry you in each gear.

Gear	1	2	3	4	5	6	7	8	9	10
Distance (cm)	293 $\frac{1}{3}$									754 $\frac{2}{7}$
Distance (Near 10 cm)	290									750

- (d) Suppose you were able to turn the pedals through 200 rotations per minute. How fast would you be traveling in each gear?

E.g. In first gear you go about 290 cm in one rotation of the pedals, thus you would travel 290×200 or 58,000 cm/min or $58,000 \times 60$ or 3,480,000 cm/h. This corresponds to 34.8 km/h.

Gear	1	2	3	4	5	6	7	8	9	10
cm/min	58,000									150,000
cm/h	3,480,000									9,000,000
km/h	34.8									90

- (e) Racing bikes have different ratios. If you had to design a racing bike, how many cogs would you put on each sprocket?
- (f) Try the exercise from the S.R.A. Kit called "Applications of Mathematics", "Everyday Things" #22.
- (g) Try to obtain a transmission from a car and perform a similar analysis of the gear ratios.

C. Problems with Proportions

1. If a computer costs \$700 per hour, how much does it cost to rent for 12 min?
2. A hamburger machine makes 34 hamburgers from 2 kg of meat. How much meat is needed for 255 hamburgers?
3. A salesman travels 222 km from Edmonton to Slave Lake in 3 h. At that rate, how far could he travel in 5 h?
4. Canned soft drinks sell at a rate of 8 cans for \$1. At that price, what is the cost of 30 cans?
5. The Coronation Swimming Pool is being filled with water at the rate of 340 ℓ in 2 min. The capacity of the pool is 30,600 ℓ. How long will it take to fill the pool?
6. Jim was paid \$6.15 for selling 410 Edmonton Journals. How much could he have earned if he had sold 600 Edmonton Journals?
7. 1350 kg of apples sold at the orchard for \$270. At that rate, what is a 30 kg sack of apples worth?
8. A Boeing 707 travels 1920 km in 2-1/2 h. At that rate, how long should it take to travel 2880 km?
9. A car used 15 ℓ of gasoline in traveling 90 km. At that rate, how many ℓ will it use on an 800 km trip?
10. Judy can buy 1 kg of coffee for \$2.38. How much will Judy pay for 6 kg of coffee?
11. In a school election at St. Mary's, Dan received five votes to every two votes Andy received. If Andy got 120 votes, how many did Dan receive?
12. A man can walk 12 km in 3 h. How far could he walk in 5 h?
13. Bread at a local store sells at 7 loaves for \$1.61. How much would 15 loaves of bread cost?
14. An automobile wheel makes 49 revolutions when travelling 294 m. How many revolutions does it make after travelling 3822 m?
15. Sugar sells at 4 kg for \$1.92. What is the cost of 10 kg of sugar?
16. Tom can earn \$6.30 in 3.5 h by delivering advertising flyers. How much could he earn in an 8 h day?
17. The height of a building is 25 m and is represented by a segment of 6 cm on a scale drawing. If another store has a height of 5 m, what is the measure of the segment representing its height?

18. Water fills the Ross Sheppard Swimming Pool at the rate of 4360 ℓ each 20 seconds. How long does it take to fill the pool if it holds 13,080,000 ℓ ?
19. A tree in the school yard casts a shadow of 24 m. At the same time a 2 m post casts a shadow 1.75 m high. How tall is the tree?
20. The ratio of the length of a side of a rectangle to its width is 8:5. If the length is 560 cm, what is the width of the rectangle?
21. The Edmonton Oil Kings won 30 out of their first 36 games. If they continue to win at the same rate, how many games can they expect to win by the end of their 78 game schedule?
22. Johnny Bench gets 6 hits for every 20 times he is at bat. During the last season he went to bat 480 times. How many hits did he get?
23. A Turbo-Prop Airplane flies from Edmonton to Winnipeg (a distance of 1120 km) in 3.5 h. How long would it take the same plane to fly from Edmonton to Vancouver (a distance of 1200 km)?
24. Mary can read 48 pages of a novel in 80 min. The novel is 384 pages long. How long will it take her to finish the novel?
25. On a blueprint, a 1 cm segment represents an actual distance of 2 m. Another segment on the same blueprint is 4 cm. What actual distance does this segment represent?
26. A man's car uses 15 ℓ of gasoline in travelling 300 km. How much gasoline would he use if he travelled 1056 km?
27. n is 65% of 75
28. 22% of 70 is n
29. 12.5 is $n\%$ of 62.5
30. $n\%$ of 30 is 150
31. n is 32% of 90
32. $1\frac{1}{2}\%$ of 68 is n
33. $3\frac{1}{2}$ is $n\%$ of 70
34. $n\%$ of 560 is 168
35. .04 is $n\%$ of 28
36. n is 68% of 75
37. A class of 56 students had only 49 present last Tuesday.
 - (a) What percent of the class was present?
 - (b) What percent of the class was absent?

D. Sports

1. The Central High School team has played 15 games this season. The record for three of the players is as follows:

<u>Player</u>	<u>Times At Bat</u>	<u>Hits</u>
Center Fielder	55	27
Shortstop	50	17
First Baseman	45	15

- (a) Calculate each player's batting average to three decimal places.
- (b) What is the probability that the shortstop gets a hit the next time at bat?
2. Collect statistics for the pass receivers of your favourite football team and calculate the probability of each player completing the next pass thrown to him.

E.

A person uses a pudding with 114 g of mix and $1\frac{1}{2}$ a ℓ of milk to serve four people.

A chef prepares food for hundreds of people. How much pudding mix and milk would he need to serve 100 people? 150 people? 350 people?

Get a recipe from a chef. Compare this recipe with a similar one in a cookbook at home. How are they different?

38. A new "Dodge Charger" sells for \$6400. During the month of May the car was selling for \$5440. The reduction was what percent of the original price?
39. A student answered 22 questions correctly on a social studies test. There were 40 questions in all. What percent did the student receive?
40. At Strathearn Junior High there are 225 grade eight students. 20% of these are honor students. How many are honor students?
41. A team won 52 out of its 78 games in a Junior High Volleyball League. What percent of their games did they win?
42. John got 35 correct out of 70 questions on his math test. What percent did he receive?
43. Sylvia got 32 correct and 68 wrong on her science test. What percent did she receive?
44. Don received 80% on a test. If there were 160 questions, how many did he answer correctly?
45. Alice got 95% on her math test. On a test of 120 questions, how many did she get wrong?

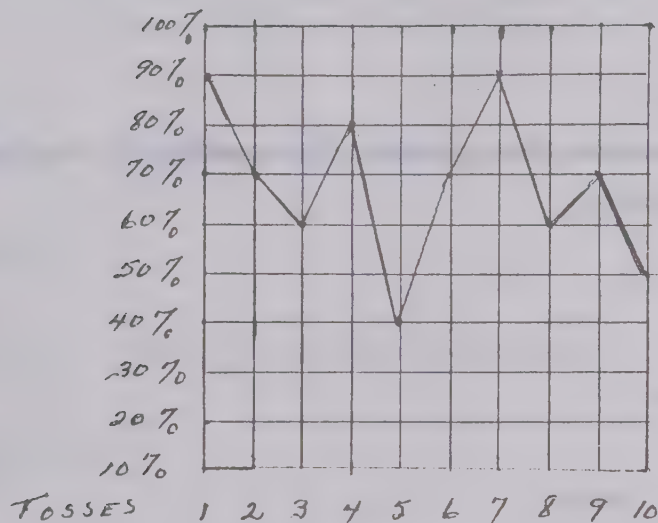
F. Probability

1. Example: We cannot tell how thumbtacks will land when we toss them until we try. Toss 10 thumbtacks for a total of 10 tosses and keep a record of the number landing up as shown in the table below.

(a) Compute the percent landing up.

(b) Graph the percent landing up as is done in the graph below.

Toss No.	1	2	3	4	5	6	7	8	9	10
NO. LANDING UP	9	7	6	8	4	7	9	6	7	5
% LANDING UP	90	70	60	80	40	70	90	60	70	50



(c) Compare the results of tossing thumbtacks with a long stem and a small head with thumbtacks that have a short stem and a large head.

2. Determine whether a coin is honest by flipping it 100 times and recording the results. Do you feel this coin is honest? Why or why not?
3. Make a spinner and divide it into 3 parts. Spin the spinner and record the three results in the order they occur. What is the probability that at least one digit will occupy its proper place?

Example: (2,2,1) the second 2 is in its proper place. Do this 20 times and calculate your results. How does this compare with your guess?

G. Banking

1. Savings Deposit



THE ROYAL BANK OF CANADA
SAVINGS ACCOUNT
DEPOSIT SLIP

YOU SHOULD BE THAT YOUR DEPOSIT IS ENTERED IN YOUR PASS BOOK WHEN MADE, OR YOU SHOULD PRESENT YOUR DEPOSIT SLIP IN DUPLICATE AND REQUEST THE TELLER TO RECEIPT AND RETURN THE DUPLICATE COPY.

DATE	DEPOSITOR'S INITIALS	TELLER

TOTAL CANADIAN CASH (INCL. COUPONS)		
LIST CHEQUES IN COLUMN 1 AND IN COLUMN 2 WHEN NECESSARY		
SUB TOTAL		
U.S. CASH		CDN. EQUIV.
SUB TOTAL		
LESS CASH RECEIVED		
NET DEPOSIT		

CUSTOMER'S SIGNATURE	ACCOUNT NO.

(a) Fill out the above form placing information in the correct space and then complete.

(1) Date

(2) Initials

(3) Account Number

(4) Cash: \$137.55

(5) Bond Coupons: (i) \$5.67 (ii) \$7.96 (iii) \$10.85

(6) Cheques: (i) \$359.75 (ii) \$572.67 (iii) \$1,096.73

(7) U.S. Cash: \$100 - discount 5%

(8) You wanted to take out \$20 cash.

(9) What would be your "Net Deposit"?

2. Current Account or Personal Chequing Account Deposit.

DEPOSIT SLIP

THE ROYAL BANK OF CANADA

MAIN BRANCH
CALGARY, ALTA.

☐ Current Account

☐ P.C.A.

CASH (INCL. CPNS.)		
CHEQUES (LIST ON REVERSE)		
SUB TOTAL		
LESS CASH AND/OR EXCHANGE		
NET DEPOSIT		

DATE

CASH
RECEIVED

(SIGNATURE)

CREDIT ACCOUNT OF

DEPOSITOR'S INITIALS

TELLER'S INITIALS

ACCOUNT
NO.

⑆00009⑆003⑆

51

(a) Fill out the following information on the above form.

(1) Date

(2) P.C.A. - for your personal chequing

(3) Initials

(4) Cash Account Number

(5) Cash and Coupons: \$78.34

(6) Cheques: (i) \$75 (ii) \$134.50 (iii) \$974.63

(7) You want to take out \$15.50 cash

(b) What is your sub total and net deposit?

(a) Fill in the following information on the above passbook form.

- (1) Name
- (2) Account Number
- (3) On January 5, 1975, you had a balance of \$100
- (4) On January 21, 1975, you bought a pair of boots for \$17.50 and you withdrew \$20 from your account.
- (5) On February 13, 1975, you bought flowers for your favourite girl (your mother) and withdrew \$8.50.
- (6) On March 2, you deposited a cheque for \$320
- (7) What was the balance on March 2?

5. Chequing

THE ROYAL BANK OF CANADA
MAIN BRANCH
339 - 8TH AVENUE S.W.
CALGARY, ALTA.



PAY TO
THE ORDER OF

S A M P L E

NO. _____

\$ _____

100 DOLLARS

⑆00009⑉003⑆

(a) Fill out the above form placing the information in the correct space.

- (1) Number of cheque: 27
- (2) Date
- (3) You bought a pair of ski boots from Simpson-Sears for \$75
- (4) Your signature

6. Other Suggested Activities:

- (1) Make arrangements with the personnel department of a commercial bank to have your students go on a guided tour of the bank. Students should find out about the various types of savings and personal chequing accounts available. How do you open these accounts? Rate of interest? What are the advantages and disadvantages of each type?
- (2) Have students compare the rate of interest on different accounts in two or more banks and/or two or more savings and loan associations.
- (3) Ask students where they would open a savings account. They should give you their reasons.

H. Income Tax

1. The income tax that individuals and business are assessed helps pay government bills.
2. You will need a federal income tax instruction booklet and income tax forms.
3. Look through the instruction booklet for filling out a federal tax form.
 - (a) What is gross income?
 - (b) What is an exemption?
 - (c) Name the kinds of exemptions allowed.
 - (d) Is a person's gross income taxed?
 - (e) What is net income?
 - (f) How do we find the net income?
 - (g) What income is the tax calculated on?
 - (h) What tax advantage does a married couple have that a single person doesn't?
4. If Bill, who is single, has a salary of \$14,000 a year, how much income tax will he pay?
5. John is married and has two sons aged 10 years and 12 years. If his salary is \$31,000 a year, how much will he pay in income tax?
6. Does the province of Alberta have an income tax? How does it compare with the federal tax?

RATIONAL NUMBER APPLICATIONS (NEGATIVE NUMBERS)

I. Banking: Loans and Credit Buying.

1. Review basic terms and types of savings and personal chequing accounts.
2. Go over the following terms:

- (a) Credit
- (b) Interest
 - (i) Simple
 - (ii) Compound
- (c) Principal
- (d) Rate
- (e) Time
- (f) Installments

3. Interest = Principal X Rate X Time

- (a) If you borrowed \$100 at 10% interest for a period of one year, what would be the interest? What would be the total amount repayable?

- (b) What happens when the principal changes?

<u>Principal</u>	<u>Rate</u>	<u>Time</u>	<u>Interest</u>	<u>Amount Repaid</u>
100	20%	1 year	\$20.00	\$120.00
200	20%	1 year		
300	20%	1 year		

- (c) What happens when the rate changes?

<u>Principal</u>	<u>Rate</u>	<u>Time</u>	<u>Interest</u>	<u>Amount Repaid</u>
\$200.00	25%	1 year	\$50.00	\$250.00
\$200.00	22%	1 year		
\$200.00	13%	1 year		

- (d) What happens when the time changes?

<u>Principal</u>	<u>Rate</u>	<u>Time</u>	<u>Interest</u>	<u>Amount Repaid</u>
\$200.00	20%	2 years	\$80.00	\$280.00
\$200.00	20%	1 year		
\$200.00	20%	6 months		

4. (1) Compute the simple interest and the amount to be repaid on a principal of \$550.00 borrowed for two years at the rate of 12% per year?
- (2) Compute the simple interest and the amount to be repaid on the principal of \$775.00 at the rate of $13\frac{1}{2}\%$ per year borrowed for six months.

- (3) Convert the following to their decimal form?

$$6\% = \underline{\hspace{2cm}}$$

$$9\% = \underline{\hspace{2cm}}$$

$$2\frac{1}{4}\% = \underline{\hspace{2cm}}$$

- (4) Complete the following:

$$4 \text{ months} = \underline{\hspace{2cm}} \text{ year.}$$

$$8 \text{ months} = \underline{\hspace{2cm}} \text{ year.}$$

$$9 \text{ months} = \underline{\hspace{2cm}} \text{ year.}$$

$$18 \text{ months} = \underline{\hspace{2cm}} \text{ years.}$$

- (5) Compute the simple interest and the amount to be repaid on the principal of \$1000 at a rate of 22% per year borrowed for over a period of eight months.

5. Have groups of students visit:

- (a) Bank.
- (b) Finance Company.
- (c) Trust Company.

- (1) Find out the types of loans available.
- (2) What is the rate of interest on each.
- (3) Who could get these loans? What would be required?
- (4) How much could be borrowed?
- (5) Find out how much it would cost the student if he borrowed \$500 over a period of 18 months for the purchase of a car.
- (6) Would a co-signer be necessary for this amount?
- (7) Would collateral be needed?
- (8) How much would the monthly payment be?
- (9) When students return, a chart should be made to compare the three loan agencies.
- (10) Students should tell when they would borrow the money and give reasons why.

6. Other suggested activities:

- (1) Invite a speaker from a local credit bureau in your community to speak to your class about establishing credit. You may want him to tell your students the following:
 - (a) How to establish credit.
 - (b) How a person can develop a good credit rating.
 - (c) What happens if a person establishes bad credit.
 - (d) The necessity for having a good credit rating.
 - (e) The concept of national credit.
- (2)
 - (a) Assign students to go to the large department stores in Calgary to find out what the requirements are for opening up a charge account. Have students compare their findings.
 - (b) Have them interview the credit managers in the large department stores to find out what their recommendations are for developing a good credit rating.
 - (c) Find out what types of charge accounts are available and how the accounts work.
 - (d) Have the students make a list of the advantages and disadvantages of having a charge account in a department store.
- (3) Invite a speaker from the charge card department of a bank in Calgary to speak to your students about using an all-purpose charge card (Chargex, Master Charge, etc.).
 - (1) How do you get an all-purpose card?
 - (2) What are some of the advantages?
 - (3) What are some of the dangers, etc.
 - (4) Recommendations of usage.
- (4) Invite a speaker from the Better Business Bureau to explain to the students the purpose and function in the community. Emphasis should be placed on how people can avoid becoming a victim of a consumer fraud or dealing with dishonest business concerns. Also, advertising could be emphasized.

J. Automobile Insurance

1. Mr. Brown bought a new car for \$6,000. He insured it against fire and theft for 80% of its value. If the rate is 70¢ per \$100, how much is the total annual premium?

How does this compare with the rate of insurance on your Dad's car?

2. Mr. Williams insures his car costing \$5,400 against fire and theft for 75% of its value. The rate is 55¢ per \$100 for fire and theft insurance. If property damage insurance cost \$33., \$10,000-\$20,000 liability insurance cost \$61.25, and \$100 deductible collision insurance cost \$86, what is his total annual premium?

Is this a good price compared with a local insurance company?

K.

Additional applications for propositions can be found in S.R.A. Math Applications Kit under:

Sports and Games #4 and #14

Everyday Things #13 and #17

Occupations #27 and #41

HISTORY

LEVEL 7

UNIT IV

**RATE. RATIO
&
PERCENT**

REFERENCES

The Committee recommends the following references as primary sources of information for Junior High School teachers and students. We suggest that those books labelled (T) be available as teacher references and those labelled (S) be available in quantities of 3 - 5 for class use. Many of these books may be in your library now and extra copies may be borrowed from the Library Service Centre.

These references are numbered (1 - 14) for referral in the following outline:

1. Adler, Irving. The Giant Golden Book of Mathematics. Golden Press, New York, 1966
510 Ad 59g (S)
2. Adler, Irving. Readings in Mathematics (book 1). Ginn and Company, Lexington, Massachusetts, 1972.
510 Ad 59r (S)
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510 Ad 59r (S)
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(These are additional references for teachers)

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Posters

1. Walch, J. W. (Publisher) "Posters on Famous Mathematics". Available on loan from the Library Service Centre.
2. I.B.M., Timeline "Men of Mathematics", available from I.B.M. Library, Calgary. Ask for item #5050003 (Free).

Busts

"Mathematicians of the Century" available from Moyer. Available on loan from the Library Service Centre. (Price \$48.00)

Movies

CK "Possibly So Pythagoros". Available on loan from Instructional
10591 Aids Department.

CK "Donald Duck in Math Magic Land". Instructional Aids.
538

Supplementary References

Page 2

Games

1. Euclid. (Western Educational Activities). For advanced students.

The resource list on Posters, Busts, Movies, and games was taken from Men of Mathematics - A Resource Unit developed by J. Barnes.

E. T. V. Math Series (produced in Ontario)
(available from Central Office)

Tape #3 part (a) Square Root: Newton's Method
(Time 20 min., 27 $\frac{1}{2}$ ft.)

Useful for introducing square roots in Grades 8 or 9.

Tape #5 part (b) History of Computers
useful as a motivational unit.

Tape #5 part (f) Number Systems
useful for introducing number theory, grade 7.

Tape #6 part (a) History of Numerals
useful in grade 7 whole numbers.

Tape #6 part (b) History of π
grade 9 Geometry

Tape #6 part (c) From Time to Time
development of calendar.

Tape #6 part (f) History of India(n) Mathematics
laid the basis for our present number system and useful in History of Math in an option.

Tape #7 part (a) Inverse Variation
grade 9 functions.

Tape #7 part (b) Graphs
grade 8 coordinate system (Descarte)

Tape #9 part (a) Fibonacci Sequence
grade 8 Real Numbers

Tape #9 part (b) The Divine Proportion: Golden Section
grade 9 Geometry

Tape #9 part (c) Map Making
useful for upper ability students in grade 9 Solid Geometry.

Tape #10 part (c) What are Numbers
history of development of number systems
useful as an introduction to grade 7 number systems.

LEVEL 7RATE, RATIO, AND PERCENTOBJECTIVESUNIT IVReference
Activities

Students should be able to:

1. Maintain previously developed skills and ideas: change fractions to an equivalent fraction whose denominator is 100.

2. Express rates, and ratios, in the form $\frac{a}{b}$.

1, 4

3. Find the missing component in any rate or ratio expressed in the equivalence condition form.

1

$$\text{e.g. } \left(\frac{3}{5} = \frac{x}{20} \right)$$

4. Solve problems involving rates and ratio.
- *5. Convert fractions to percent.
- *6. Convert percent to fractions.
- *7. Convert decimals to percent.
- *8. Convert percent to decimals.
- *9. Solve problems involving percent.

2, 3, 4

UNIT IV:

RATE, RATIO, AND PERCENT

RESOURCES

Eudoxus (408 - 355 B.C.) - Wrote the first detailed theory of proportions.

Reference #14, pages 94-96

Reference #4, pages 25-28

Blaise Pascal (1623 - 1662) - Theory of probability involving the idea of proportion.

Reference #1, pages 71-73

Reference #5, pages 128-147

Reference #2 (exercises) pages 21-32

Pythagoras (567 - 497 B.C.) - Proportional patterns in music.

Reference #1, pages 77-78

Reference #5, pages 42-43

Pierre de Fermat (1601 - 1665) - With Pascal he developed the theory of probabilities.

Reference #5, pages 128-147

Reference #4, pages 56-70

The Golden Ratio

Reference #5, pages 94-97

Reference #1, page 32

UNIT IV:

RATE, RATIO, AND PERCENT

ACTIVITIES

1. The general theory of proportions states that if

$$\frac{a}{b} \quad \dots \quad \frac{c}{d} \quad \text{then } ad = bc.$$

Who was the first person to discover this theory?

The Mathmen (reference #14) page 95

Men of Mathematics (reference #4) page 25

2. Proportions can be used to determine the probability that a certain event will occur. e.g. the chance of rain in 6/10. Pascal and Fermat contributed a great deal to our knowledge of probability. What were some of their contributions?

Mathematics (reference #5) pages 144-145

The Giant Golden Book of Math (reference #1) pages 72-73

Mathematics (reference #5) pages 128-129, 137, 139

3. Read pages 21 - 30 in Readings in Math: Book 1 (reference #2) and do the questions on page 30.

4. (a) What was the golden ratio? (Sometimes called the golden section or golden rectangle)

(b) How is it used?

(c) Complete the investigation page 64 of Mathematics: Man's Key to Progress (reference #6)

Mathematics (reference #5) pages 94-97

The Giant Golden Book of Mathematics (reference #1) page 32

LEARNING

PACKAGE

LEVEL SEVEN

UNIT IV

RATE, RATIO.

&

PERCENT

UNIT IV - RATE, RATIO AND PERCENT

PERFORMANCE OBJECTIVES

Students should be able to:

1. Maintain previously developed skills and ideas: change fractions to an equivalent fraction whose denominator is 100.
2. Express rates, and ratios, in the form $\frac{a}{b}$.
3. Find the missing component in any rate or ratio expressed in the equivalence condition form.
e.g. $(\frac{3}{5} = \frac{x}{20})$
4. Solve problems involving rates and ratio.
- *5. Convert fractions to percent.
- *6. Convert percent to fractions.
- *7. Convert decimals to percent.
- *8. Convert percent to decimals.
- *9. Solve problems involving percent.

DEVELOPMENT AND EXERCISES

STRAND: Rate, Ratio & Percent

LEVEL: 7

UNIT: IV

OBJECTIVE NUMBER: 1

OBJECTIVE: Maintain previously developed skills and ideas: change fractions to equivalent fractions whose denominator is 100.

- SUGGESTED DEVELOPMENT: 1. Discuss with the class the reason for changing to equivalent fractions with denominators of 100. (Ease of comparison).
- (a) fractions with common denominators.
- (b) fractions with denominators of 100 (Since we will be studying percent).

2. Review method of conversion to denominators of 100.

- (a) Definition of equivalence:

EXAMPLE: $\frac{1}{4} = \frac{x}{100}$

$$1 \times 100 = x(4)$$

$$25 = x \quad \text{so} \quad \frac{1}{4} = \frac{25}{100}$$

- (b) Principle of equivalent fractions:

EXAMPLE: $\frac{1}{4} = \frac{x}{100}$ (Multiply numerator and denominator by 25)

$$\frac{1 \times 25}{4 \times 25} = \frac{x}{100}$$

$$x = 25 \quad \text{so} \quad \frac{1}{4} = \frac{25}{100}$$

3. Do examples which use the value of 100 for the denominator.

EXAMPLE: (a) Marks on exams: Which is the better score, 30 correct out of 60 or 23 correct out of 92?

- (i) 30 test questions correct out of 60.

$$\frac{30}{60} = \frac{x}{100}$$

$$60(x) = 30 \times 100 \quad (\text{Definition of equivalence})$$

$$x = 50$$

- 37 -

$$\text{so } \frac{30}{60} = \frac{50}{100}$$

- (ii) 23 test questions correct out of 92.

$$\frac{23}{92} = \frac{x}{100}$$

$$23 \times 100 = 92(x)$$

$$25 = x \quad \text{so} \quad \frac{23}{92} = \frac{25}{100}$$

Now marks from (i) and (ii) can easily be compared.

EXAMPLE: (b) Cost of items in a supermarket: Which toothpaste is less expensive: 150 ml for 75¢ or 75 ml for 50¢?

- (i) Brand A: 150 ml of tooth paste for 75 cents.

$$\frac{150}{75} = \frac{t}{100}$$

$$150 \times 100 = t \times 75$$

$$200 = t \quad \text{so} \quad \frac{150}{75} = \frac{200}{100}$$

- (ii) Brand B: 75 ml of tooth paste for 50 cents.

$$\frac{75}{50} = \frac{t}{100}$$

$$75 \times 100 = t \times 50$$

$$150 = t \quad \text{so} \quad \frac{75}{50} = \frac{150}{100}$$

Now the cost of tooth paste for Brand A and Brand B can easily be compared.

EXERCISES:

OBJECTIVE NO. 1

I. For each set of equivalent fractions find the value of the variable.

$$\frac{3}{4} = \frac{n}{100}$$

$$(1) \frac{3}{4} \times \frac{25}{25} = \frac{n}{100} \quad \text{TWO STEPS!}$$

$$(2) n = 75$$

1. $\frac{3}{2} = \frac{k}{100}$ 150 2. $\frac{n}{100} = \frac{5}{4}$ 125 3. $\frac{2}{5} = \frac{x}{100}$ 40
4. $\frac{16}{5} = \frac{n}{100}$ 320 5. $\frac{n}{100} = \frac{7}{10}$ 70 6. $\frac{12}{10} = \frac{x}{100}$ 120
7. $\frac{25}{20} = \frac{x}{100}$ 125 8. $\frac{15}{25} = \frac{t}{100}$ 60 9. $\frac{78}{50} = \frac{x}{100}$ 156
10. $\frac{57}{100} = \frac{x}{100}$ 57 *11. $\frac{84}{200} = \frac{t}{100}$ 42 *12. $\frac{x}{100} = \frac{57}{190}$ 30

II. Write a fraction with denominator of 100, equivalent to each of the following:

EXAMPLE: $\frac{6}{20} = ?$

$$\frac{n}{100} = \frac{6}{20}$$

$$20 \times n = 6 \times 100$$

$$n = 30$$

1. $\frac{1}{2}$ $\frac{50}{100}$ 2. $\frac{5}{2}$ $\frac{250}{100}$ 3. $\frac{3}{4}$ $\frac{75}{100}$ 4. $\frac{21}{4}$ $\frac{525}{100}$
5. $\frac{2}{5}$ $\frac{40}{100}$ 6. $\frac{7}{5}$ $\frac{140}{100}$ 7. $\frac{9}{10}$ $\frac{90}{100}$ 8. $\frac{16}{10}$ $\frac{160}{100}$
9. $\frac{26}{10}$ $\frac{260}{100}$ 10. $\frac{15}{20}$ $\frac{75}{100}$ 11. $\frac{16}{20}$ $\frac{80}{100}$ 12. $\frac{19}{20}$ $\frac{95}{100}$
13. $\frac{75}{20}$ $\frac{375}{100}$ 14. $\frac{4}{25}$ $\frac{16}{100}$ 15. $\frac{24}{25}$ $\frac{96}{100}$ 16. $\frac{23}{50}$ $\frac{46}{100}$
17. $\frac{49}{50}$ $\frac{98}{100}$ 18. $\frac{121}{100}$ $\frac{121}{100}$ 19. $\frac{23}{46}$ $\frac{50}{100}$ 20. $\frac{134}{200}$ $\frac{67}{100}$

DEVELOPMENT AND EXERCISES

STRAND: Rate, Ratio & Percent

LEVEL: 7

UNIT: IV

OBJECTIVE NUMBER: 2

OBJECTIVE: Express rates and ratios in the form $\frac{a}{b}$.

SUGGESTED DEVELOPMENT: 1. As the mathematical concepts of rate and ratio are very similar, little should be made of definitions beyond the following:

RATE: Method of expressing a relation involving units.

eg. Rate of 6 bubble gum for 12¢.

RATIO: Method of expressing a relation without units.

eg. The ratio of number of bubble gum to number of cents is 6:12.

2. Discuss the above definitions with the class and ask for further examples of use of rate and ratio.

eg. (i) price : items

(ii) km : hours

(iii) km : litres

(iv) number correct : total number

(v) hits : times at bat

3. Discuss the $\frac{a}{b}$ form of expressing rates or ratio.

eg. Rate of 50 km/hour = 50:1 ratio = $\frac{50}{1}$

NOTE: The same idea could be expressed as $\frac{1}{50}$ where numerator represents hours, and denominator represents miles.

4. Discuss the simplification of a rate or ratio to its basic fraction.

eg. If you drove from Edmonton to Red Deer a distance of 160 km in 2 hours, what is your rate expressed as a fraction in lowest terms?

$$160 \text{ km} : 2 \text{ h} = \frac{160}{2} \frac{\text{km}}{\text{h}} = \frac{80}{1} \frac{\text{km}}{\text{h}}$$

The rate then is 80 km per hour.

RATES AND RATIOS

RATE	RATIO
<p>METHOD OF EXPRESSING A RELATION INVOLVING NUMBERS AND UNITS</p> <p><u>EXAMPLE</u></p> <p>THE CAR TRAVELLED AT A RATE OF 100 km PER HOUR</p>	<p>METHOD OF EXPRESSING A RELATION INVOLVING ONLY NUMBERS</p> <p><u>EXAMPLE</u></p> <p>THE RATIO OF BOYS TO GIRLS IN THE DRAMA CLUB IS 3:5</p>
<p>ANY <u>RATE</u> MAY BE EXPRESSED AS A <u>RATIO</u></p>	

RATES AND RATIOS

ANY
RATE OR RATIO
 MAY BE EXPRESSED
 IN THE FORM $\frac{a}{b}$

rate	ratio	$\frac{a}{b}$
100 km PER HOUR	100:1	$\frac{100}{1}$
3 CANS OF POP FOR 40 CENTS	3:40	$\frac{3}{40}$
1 kg OF STEAK FOR \$4.25	1:4.25	$\frac{1}{4.25}$

EXERCISES:

OBJECTIVE NO. 2

State the following rates as a ratio and as a fraction in lowest terms.

- 1) 30 km in 2 hours. $30:2$ $\frac{15}{1}$
- 2) 3 hits for 10 attempts at bat. $3:10$ $\frac{3}{10}$
- 3) 1750 revolutions in 5 seconds. $1750:5$ $\frac{350}{1}$
- 4) 3 cans for 90 cents. $3:90$ $\frac{1}{30}$
- 5) 84 km on 12 litres of gas. $84:12$ $\frac{7}{1}$
- 6) 2 dozen eggs for \$1.50. $2:150$ $\frac{1}{75}$
- 7) 900 km in 15 hours. $900:15$ $\frac{60}{1}$
- 8) 75 answers correct out of a possible 100 questions. $75:100$ $\frac{3}{4}$
- 9) 100 m in 10 seconds. $100:10$ $\frac{10}{1}$
- 10) 45 revolutions in 3 minutes. $45:3$ $\frac{15}{1}$
- 11) 50 teeth on a front sprocket and 10 in a back sprocket. $50:10$ $\frac{5}{1}$
- 12) Number of boys in your class to total number of students in your class.
- 13) Number of grade seven classes to total number of classes in your school.
- 14) Number of science teachers to math teachers.
- 15) Teams in NHL playoffs to total teams.
- 16) Number of m in a km to number of cm in a km. $1000:100\ 000$ $\frac{1}{100}$
- 17) Number of cm in a m to mm in a cm. $100:10$ $\frac{10}{1}$
- 18) 40 hits to 100 times at bat. $40:100$ $\frac{2}{5}$
- 19) 5 cans of peas for \$1.00. $5:100$ $\frac{1}{20}$
- 20) 4 goals in 160 shots on goal. $4:160$ $\frac{1}{40}$
- 21) The number of legs on a frog to the number of legs on a spider. $4:8$ $\frac{1}{2}$
- 22) The number of cents in fifty cents to the number of cents in five dollars. $50:500$ $\frac{1}{10}$
- 23) The number of minutes in 1 hour and the number of minutes in one day. $60:1440$ $\frac{1}{24}$
- 24) The number of Canadian provinces to the number of provincial capitals. $10:10$ $\frac{1}{1}$
- 25) The number of windows in your classroom to the number of doors in the room.
- 26) The number of players in the starting line up of a hockey team to the number on a baseball team. $6:9$ $\frac{2}{3}$



STRAND:	<u>Rate, Ratio & Percent</u>	LEVEL:	<u>7</u>
UNIT:	<u>IV</u>	OBJECTIVE NUMBER:	<u>3</u>
OBJECTIVE:	<u>Find the missing component in any rate or ratio expressed in the equivalent condition form.</u>		

SUGGESTED DEVELOPMENT: 1) First the teacher must decide which of the following three methods he prefers to use, based on the background of the students.

2) NOTE: Definition of equivalence can be used in all cases, other methods are more specialized, depending on particular questions.

3) Review equivalence (principle of equivalent fractions).

$\text{eg. } \frac{1}{2} = \frac{2}{4}$ $\text{Since } \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$	$\left\{ \begin{array}{l} \text{Draw student attention to:} \\ \text{if } \frac{1}{2} = \frac{2}{4} \\ \text{then } 1 \times 4 = 2 \times 2 \\ \text{(basis, and preliminary to ratio test)} \end{array} \right.$
$\text{eg. } \frac{2}{3} = \frac{8}{12}$ $\text{Since } \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$	$\left\{ \begin{array}{l} \text{Re-emphasize the above.} \end{array} \right.$

4) Show one or all three of the following methods:

(a) <u>Definition of</u> <u>Equivalence</u>	b) <u>Equivalent</u> <u>Fractions</u>	c) <u>Multiplicative</u> <u>Inverses</u>
--	--	---

$\frac{3}{4} = \frac{x}{8}$	$\frac{3}{4} = \frac{x}{8}$	$\frac{3}{4} = \frac{x}{8}$
$3(8) = 4x$	if $4 \times 2 = 8$	$8(\frac{3}{4}) = \frac{x}{8}(8)$
$\frac{3(8)}{4} = x$	then $3 \times 2 = x$	$\frac{8(3)}{4} = x$
$6 = x$	$6 = x$	$6 = x$
	$\therefore \frac{3}{4} = \frac{6}{8}$	

EXERCISES:

OBJECTIVE NO. 3

A. Find the missing component in each of the following equivalent fractions:

$$\frac{3}{15} = \frac{n}{60}$$

$$15 \times n = 3 \times 60$$

$$n = 12$$

THREE CORRECT METHODS
USE THE ONE YOU FIND

EASIEST

$$\frac{5}{8} = \frac{n}{24}$$

$$\frac{5}{8} \times 24 = \frac{n}{24} \times 24$$

$$15 = n$$

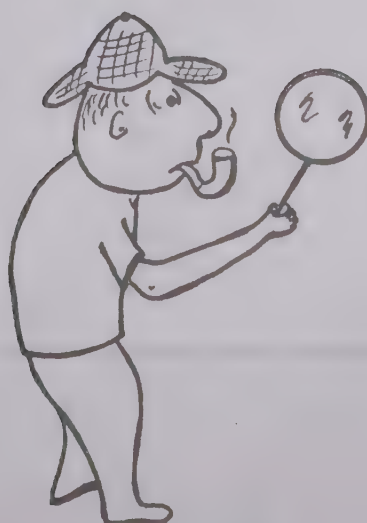
$$\frac{5}{12} = \frac{n}{48}$$

$$12 \times 4 = 48$$

$$\text{so } 5 \times 4 = n$$

$$n = 20$$

- | | | | | | |
|------------------------------------|----------------|-------------------------------------|-----------------|-------------------------------------|----|
| 1. $\frac{3}{10} = \frac{x}{20}$ | 6 | 2. $\frac{4}{5} = \frac{k}{10}$ | 8 | 3. $\frac{70}{80} = \frac{p}{16}$ | 14 |
| 4. $\frac{7}{t} = \frac{35}{40}$ | 8 | 5. $\frac{1}{3} = \frac{r}{12}$ | 4 | 6. $\frac{m}{64} = \frac{7}{16}$ | 28 |
| 7. $\frac{9}{18} = \frac{25}{n}$ | 50 | 8. $\frac{7}{14} = \frac{42}{x}$ | 84 | 9. $\frac{100}{46} = \frac{q}{23}$ | 50 |
| 10. $\frac{42}{x} = \frac{7}{6}$ | 36 | 11. $\frac{3}{2} = \frac{x}{150}$ | 225 | 12. $\frac{1}{5} = \frac{m}{25}$ | 5 |
| 13. $\frac{4}{5} = \frac{x}{100}$ | 80 | 14. $\frac{5}{6} = \frac{35}{n}$ | 42 | 15. $\frac{7}{8} = \frac{77}{p}$ | 88 |
| 16. $\frac{6}{8} = \frac{5}{s}$ | $6\frac{2}{3}$ | 17. $\frac{16}{4} = \frac{5}{p}$ | $1\frac{1}{4}$ | 18. $\frac{13}{39} = \frac{x}{180}$ | 60 |
| 19. $\frac{42}{36} = \frac{28}{r}$ | 24 | 20. $\frac{p}{5} = \frac{375}{120}$ | $15\frac{5}{8}$ | | |



$$\frac{5}{t} = \frac{25}{37}$$

WHAT TO DO??

FLIPPEROO !!

$$\frac{t}{5} = \frac{37}{25}$$

FIND THE MISSING COMPONENT

$$\frac{2}{3} = \frac{x}{12}$$

$$3(x) = 2(12) \quad \therefore \frac{2}{3} = \frac{8}{12}$$

$$3x = 24$$

$$x = \frac{24}{3}$$

$$x = 8$$

FIND THE MISSING COMPONENT

$$1. \quad \frac{1}{5} = \frac{x}{30}$$

$$2. \quad \frac{6}{7} = \frac{42}{y}$$

$$3. \quad \frac{4}{x} = \frac{56}{42}$$

EXERCISES:

OBJECTIVE NO. 3

RATIO AND PROPORTION

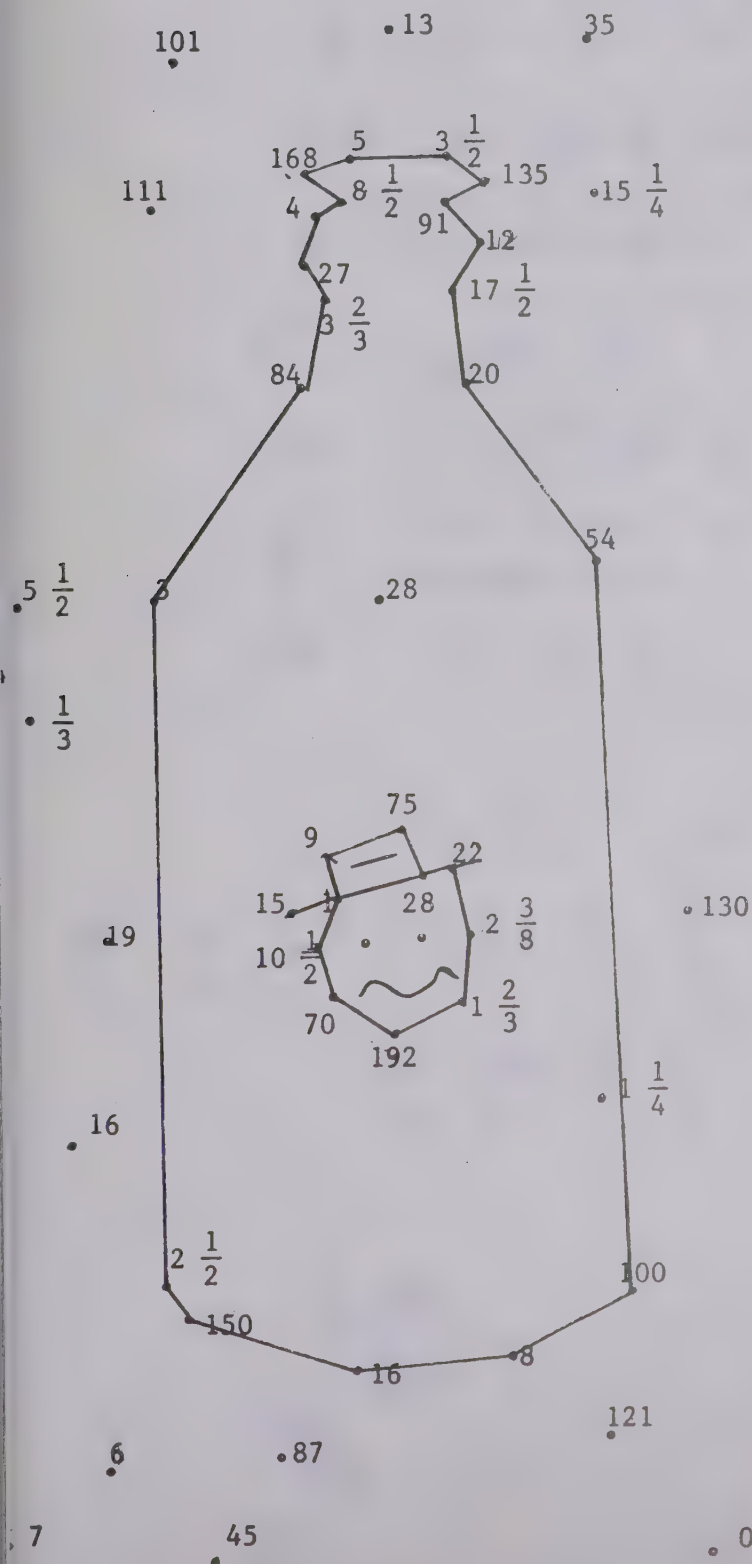
B. DIRECTIONS: Solve each question. Connect the answers in order. Do all of 'A' first.

A

1. $2:3 = x:12$ 8
2. $4:x = 9:36$ 16
3. $5:10 = 75:x$ 150
4. $6:x = 12:5$ $2\frac{1}{2}$
5. $x:9 = 8:24$ 3
6. $6:11 = x:154$ 84
7. $x:11 = 7:21$ $3\frac{2}{3}$
8. $9:16 = x:48$ 27
9. $8:72 = x:36$ 4
10. $17:2 = x:1$ $8\frac{1}{2}$
11. $14:16 = x:192$ 168
12. $15:x = 39:13$ 5
13. $7:8 = x:4$ $3\frac{1}{2}$
14. $45:x = 96:288$ 135
15. $133:19 = x:13$ 91
16. $3:5 = x:20$ 12
17. $2:7 = 5:x$ $17\frac{1}{2}$
18. $5:7 = x:28$ 20
19. $36:x = 2:3$ 54
20. $25:4 = x:16$ 100
21. $15:24 = 5:x$ 8

B

1. $25:x = 15:9$ 15
2. $15:180 = x:12$ 1
3. $65:15 = 39:x$ 9
4. $x:100 = 36:48$ 75
5. $35:45 = x:36$ 28
6. $33:x = 21:14$ 22
7. $x:15 = 19:120$ $2\frac{1}{3}$
8. $5:x = 9:3$ $1\frac{2}{3}$
9. $x:432 = 4:9$ 192
10. $35:31 = x:62$ 70
11. $21:5 = x:2.5$ $10\frac{1}{2}$
12. $4:4 = x:1$ 1



REVIEW EXERCISES:

OBJECTIVE NO'S 1 - 3

- Find answers to each of the questions below.
- Place the letter at the left of each question in the corresponding blank at the bottom of the page. (match answers). Warning: Some letters will be used more than once.
- When you have correctly answered all questions and matched accordingly, you will have the answer to this riddle:

WHAT IS LARGE, GREEN, AND SWIMS IN THE OCEAN?

E: $\frac{3}{5} = \frac{x}{100}$; $x = ?$ 60

N: $\frac{4}{7} = \frac{x}{14}$; $x = ?$ 8

K: $\frac{x}{10} = \frac{40}{100}$; $x = ?$ 4

Y: $\frac{42}{63} = \frac{14}{x}$; $x = ?$ 21

W: $\frac{7}{2} = \frac{x}{100}$; $x = ?$ 350

I: $\frac{121}{11} = \frac{22}{x}$; $x = ?$ 2

S: $\frac{1}{x} = \frac{20}{100}$; $x = ?$ 5

A: $8:20 = x:40$, $x = ?$ 16

O: The ratio $\frac{72}{108}$ reduced. $\frac{2}{3}$

T: $\frac{36}{100} = \frac{9}{x}$; $x = ?$ 25

B: Ratio of 3 cans of soup for \$1.00. $\frac{3}{1}$

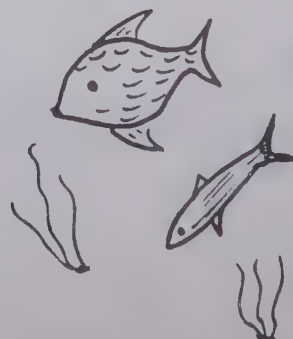
M: Ratio of 5 litres of gas per 2 km. $\frac{5}{2}$

D: The ratio $\frac{8}{4}$ reduced. $\frac{2}{1}$

L: $\frac{x}{100} = \frac{1}{5}$; $x = ?$ 20

H: Ratio $\frac{1}{2}$ dozen pop cans for \$1.00. $\frac{6}{1}$

$\frac{T}{25}$	$\frac{H}{\frac{6}{1}}$	$\frac{E}{60}$	$\frac{W}{350}$	$\frac{H}{\frac{6}{1}}$	$\frac{A}{16}$	$\frac{L}{20}$	$\frac{E}{60}$	$\frac{K}{4}$	$\frac{N}{8}$	$\frac{O}{\frac{2}{3}}$	$\frac{W}{350}$	$\frac{N}{8}$
$\frac{A}{16}$	$\frac{S}{5}$	$\frac{M}{\frac{5}{2}}$	$\frac{O}{\frac{2}{3}}$	$\frac{B}{\frac{3}{1}}$	$\frac{Y}{21}$	$\frac{D}{\frac{2}{1}}$	$\frac{I}{2}$	$\frac{L}{20}$	$\frac{L}{20}$			



DEVELOPMENT AND EXERCISES

STRAND:	<u>Rate, Ratio & Percent</u>	LEVEL:	<u>7</u>
UNIT:	<u>IV</u>	OBJECTIVE NUMBER:	<u>4</u>
OBJECTIVE:	<u>Solve problems involving rates and ratio.</u>		
<hr/>			

SUGGESTED DEVELOPMENT: Class Discussion:

Discuss and review the steps of problem solving which are:

- (i) Read problem carefully.
- (ii) Define the variable. (Correct units)
- (iii) Translate the question to a mathematical equation.
- (iv) Solve equation.
- (v) State answer with correct units.

EXAMPLE PROBLEM:

✓ Two partners share their profits in the ratio of 1:3.
If the partner of the larger share receives \$2100.00,
how much should the other partner receive?

SOLUTION:

- (i) Read.
- (ii) Define variable (Let x be the amount in dollars the other partner receives).
- (iii) Translate. $\frac{1}{3} = \frac{x}{2100}$
- (iv) Solve. $1(2100) = 3x$
$$\frac{2100}{3} = x$$
$$700 = x$$
- (v) Answer in correct units: Second partner received \$700.00.

EXERCISES:

OBJECTIVE NO. 4

Use the steps of problem solving to solve each problem.

1. A salesman travels 225 km from Edmonton to Slave Lake in 3 hours. At that rate, how far could he travel in 5 hours? **375 km**
2. Canned soft drinks sell at a rate of 8 cans for \$1.00. At that price, what is the cost of 30 cans? **\$ 3.75**
3. The Coronation Swimming Pool is being filled with water at the rate of 350 litres in 2 minutes. The capacity of the pool is 28 000 litres. How long will it take to fill the pool? **160 min**
4. Jim was paid \$6.15 for selling 410 Edmonton Journals. How much could he have earned if he had sold 600 Edmonton Journals? **\$ 9.00**
5. One and one-half tonne of apples sold at the orchard for \$420.00. At that rate, what is a 25 kg sack of apples worth? (1 tonne = 1000 kg) **\$ 21.00**
6. A Boeing 707 travels 2000 km in 2.5 hours. At that rate, how long should it take to travel 1200 kilometres? **1.5 h**
7. A car used 15 litres of gasoline in travelling 90 kilometres. At that rate, how many litres will it use on a 800 kilometre trip? **133.3 l**
8. Judy can buy 2 kg of coffee for \$4.76. How much will Judy pay for 6 kg of coffee? **\$ 14.28**
9. In a school election at St. Mary's, Dan received five votes to every two votes Andy received. If Andy got 120 votes, how many did Dan receive? **300 votes**
10. The ratio of red jelly beans to yellow jelly beans is 4:3. In a mixture of candy, if there are 16 kg of red jelly beans, how many kilograms of yellow jelly beans are there? **12 kg**
11. The ratio of the length of a side of a rectangle to its width is 6:5. If the length is 30 cm, what is the width? **25 cm**
12. Bob gets 7 hits for every 15 times he is at bat. Last year, while playing baseball he was at bat 45 times. How many hits did he get? **21 hits**
13. At four o'clock during the month of May, the ratio of a man's height to the shadow he casts is 9:5. If a man is 180 cm tall, how long is his shadow at four o'clock? **100 cm**
14. A stack of 40 papers is 1 cm high. How high is a stack of 260 papers? **6.5 cm**
15. A certain stock is listed at \$50.50 per share. At that rate, how many shares of this stock can Mr. King buy for \$1000.00? **19 Shares**
16. On a map scale a line 5 cm long represents 100 km. How long a line is needed to represent a distance of 340 kilometres? **17.0 cm**

EXERCISES:

OBJECTIVE NO. 4

17. If a boy can walk from his house to school (10 blocks) in 15 minutes, how long would it take him to go at the same rate from his house to the corner store 5 blocks beyond the school? **22.5 min**
18. My two year old daughter takes 9 steps to go as far as I do in 2 steps. At this rate, how many steps will she take to cover the distance I go in 360 steps? **1620 steps**
19. A man wants to buy some root beer for his family.
Two stores advertise the following:
Store A: 5 glasses for \$1.15
Store B: 6 glasses for \$1.26
- (a) Which store sells at the cheaper rate? **Store B**
- (b) At this rate, how much would he pay for 8 glasses? **\$1.68**



STRAND: Rate, Ratio & Percent

LEVEL: 7

UNIT: IV

OBJECTIVE NUMBER: 5

OBJECTIVE: * Convert fractions to percent.

- SUGGESTED DEVELOPMENT:
1. Discuss with students the idea that percent is a fractional number with denominator understood to be 100.
 2. Discuss with students the idea and reasons for converting a ratio to a percent. (Ease of comparison)
 3. You may use any of the basic methods of converting a fraction to a percent. The definition of equivalence is again recommended but the others have merit in specific cases.

a) Memory if denominator is already 100	b) Definition of Equivalence	c) Equivalence	d) Multiplicative Inverse
$\frac{60}{100} = 60\%$ Drop denominator and add percent sign.	$\frac{30}{50} = \frac{x}{100}$ $30(100) = x(50)$ $\frac{30(100)}{50} = x$ $60 = x$ $\frac{30}{50} = \frac{60}{100}$ $\therefore 60\%$	$\frac{30}{50} = \frac{x}{100}$ $\frac{30 \times 2}{50 \times 2} = \frac{60}{100}$ $x = 60$ $\therefore 60\%$	$\frac{30}{50} = \frac{x}{100}$ $\frac{30}{50} \times 100 = \frac{x}{100} \times 100$ $\frac{30 \times 100}{50} = x$ $60 = x$ $\therefore 60\%$

4. Discuss conversion of mixed numbers to percents.

$$3 \frac{3}{4} = \frac{x}{100}$$

$$\frac{15}{4} = \frac{x}{100}$$

$$15 \times 100 = 4(x)$$

$$375 = x$$

$$\therefore 375\%$$

FRACTIONS & PERCENTS

FRACTION \longrightarrow PERCENT

PERCENT MEANS

"OUT OF 100"

THEREFORE TO CHANGE
A FRACTION TO A PERCENT
CHANGE THE FRACTION
TO AN EQUIVALENT
FRACTION WITH A
DENOMINATOR OF 100.

E.G. TO CHANGE $\frac{3}{5}$ TO A PERCENT

$$\frac{3}{5} = \frac{x}{100} \quad \text{SO} \quad \frac{3}{5} = \frac{60}{100}$$

$$300 = 5x \quad \therefore \quad \frac{3}{5} = 60\%$$

$$60 = x$$

FRACTIONS \longrightarrow PERCENTS

CONVERT EACH OF THE FOLLOWING
TO PERCENTS

1. $\frac{8}{10} =$

2. $\frac{3}{4} =$

3. $\frac{1}{8} =$

4. $1\frac{1}{2} =$

5. $\frac{1}{3} =$

EXERCISES:

OBJECTIVE NO. 5

Find the missing numerator, then write as a percent. Do as many as you can by inspection.

$$1) \frac{1}{4} = \frac{25}{100} = \underline{25}\%$$

$$2) \frac{2}{3} = \frac{66\frac{2}{3}}{100} = \underline{66\frac{2}{3}}\%$$

$$3) \frac{3}{8} = \frac{37.5}{100} = \underline{37.5}\%$$

$$4) \frac{5}{8} = \frac{62.5}{100} = \underline{62.5}\%$$

$$5) \frac{1}{5} = \frac{20}{100} = \underline{20}\%$$

$$6) \frac{5}{6} = \frac{83.\bar{3}}{100} = \underline{83.\bar{3}}\%$$

$$7) \frac{8}{5} = \frac{160}{100} = \underline{160}\%$$

$$8) \frac{27}{20} = \frac{135}{100} = \underline{135}\%$$

$$9) \frac{38}{15} = \frac{253.\bar{3}}{100} = \underline{253.\bar{3}}\%$$

$$10) \frac{1}{6} = \frac{16.\bar{6}}{100} = \underline{16.\bar{6}}\%$$

$$11) 3\frac{1}{5} = \frac{320}{100} = \underline{320}\%$$

$$12) \frac{125}{1000} = \frac{12.5}{100} = \underline{12.5}\%$$

$$13) \frac{60}{500} = \frac{12}{100} = \underline{12}\%$$

$$\frac{7}{16} = \frac{\quad}{100} = \underline{\quad}\%$$

$$\frac{7}{16} \times 100 = \frac{n}{100} \times 100$$

$$n = \frac{700}{16}$$

$$n = 43\frac{3}{4}$$

$$\therefore 43\frac{3}{4}\%$$

$$14) 1\frac{3}{4} = \frac{175}{100} = \underline{175}\%$$

$$15) 3\frac{1}{4} = \frac{325}{100} = \underline{325}\%$$

$$16) 17\frac{4}{5} = \frac{1780}{100} = \underline{1780}\%$$

$$17) \frac{17}{25} = \frac{68}{100} = \underline{68}\%$$

$$18) \frac{8}{96} = \frac{8.\bar{3}}{100} = \underline{8.\bar{3}}\%$$

$$19) 7\frac{5}{8} = \frac{762.5}{100} = \underline{762.5}\%$$

$$20) 5\frac{1}{5} = \frac{520}{100} = \underline{520}\%$$

MEMORY BANK

Fraction	%
$\frac{1}{2}$	50
$\frac{1}{3}$	$33\frac{1}{3}$
$\frac{2}{3}$	$66\frac{2}{3}$
$\frac{1}{4}$	25
$\frac{3}{4}$	75
$\frac{1}{5}$	20
$\frac{2}{5}$	40
$\frac{3}{5}$	60
$\frac{4}{5}$	80

THINK!

$$\frac{1}{4} \rightarrow 25\%$$

$$2\frac{3}{4} = \frac{11}{4} \quad 11 \times \frac{1}{4}$$

$$= 11 \times 25\%$$

$$2\frac{3}{4} = 275\%$$



DEVELOPMENT AND EXERCISES

STRAND: Rate, Ratio & Percent

LEVEL: 7

UNIT: IV

OBJECTIVE NUMBER: 6

OBJECTIVE: * Convert percent to fractions.

- SUGGESTED DEVELOPMENT:
1. Re-affirm the concept that the symbol % indicates a fraction with a denominator of one hundred.
 2. Review the concept of reduction of fractions.
 3. Begin with an easier example, such as:
50% means fifty-hundredths which in fractional form is $\frac{50}{100}$, and $\frac{50}{100} = \frac{1}{2}$ by successive division or simplification.
 4. Develop the following examples to show students different forms and different methods of simplification.

a) Simplification using decimals.

$$\begin{aligned} 22.5\% \text{ means } \frac{22.5}{100} &= \frac{22.5 \times 10}{100 \times 10} \text{ (to remove decimal point)} \\ &= \frac{225}{1000} \\ &= \frac{9}{40} \end{aligned}$$

b) The following methods are similar, therefore, the teacher should choose the method most closely related to student background and ability.

Method (ii) is recommended.

(i) $16 \frac{2}{3} \%$

(ii) $33 \frac{1}{3} \%$

$$\frac{16 \frac{2}{3}}{100} = \frac{\frac{50}{3}}{100}$$

$$= \frac{\frac{50}{3} \times 3}{100 \times 3}$$

$$= \frac{50}{300}$$

$$= \frac{1}{6}$$

$$\frac{33 \frac{1}{3}}{100} = 33 \frac{1}{3} \div 100$$

$$= 33 \frac{1}{3} \times \frac{1}{100}$$

$$= \frac{100}{3} \times \frac{1}{100}$$

$$= \frac{1}{3}$$

FRACTIONS & PERCENTS

PERCENT \longrightarrow FRACTION

PERCENT MEANS

"OUT OF 100"

THEREFORE TO CHANGE
A PERCENT TO A FRACTION
WRITE THE PERCENT OVER
A DENOMINATOR OF 100
AND REDUCE THE FRACTION

E.G. TO CHANGE 35%

TO A FRACTION

$$35\% = \frac{35}{100} = \frac{7}{20}$$

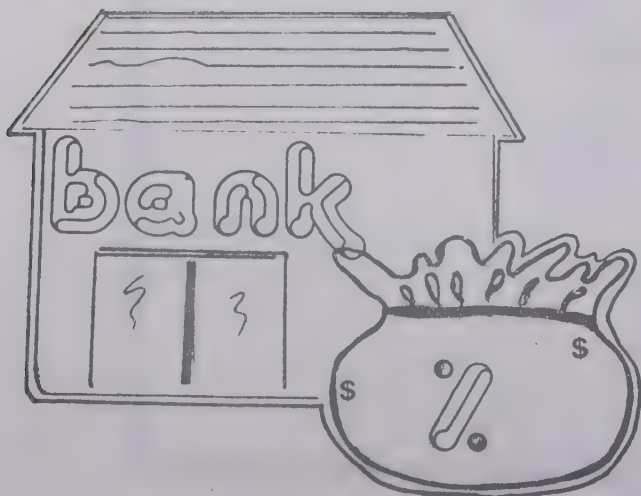
$$\therefore 35\% = \frac{7}{20}$$

EXERCISES:

OBJECTIVE NO. 6

Express the following percents as basic fractions: (You may use your memory bank).

- | | | | |
|---------------------------------------|----------------------------|-------------------------------------|--------------------------------------|
| 1. 25% $\frac{1}{4}$ | 2. 75% $\frac{3}{4}$ | 3. 60% $\frac{3}{5}$ | 4. $87\frac{1}{2}\%$ $\frac{7}{8}$ |
| 5. $33\frac{1}{3}\%$ $\frac{1}{3}$ | 6. 125% $1\frac{1}{4}$ | 7. $37\frac{1}{2}\%$ $\frac{3}{8}$ | 8. $116\frac{2}{3}\%$ $1\frac{1}{6}$ |
| 9. 12.25% $\frac{49}{400}$ | 10. 119% $1\frac{19}{100}$ | 11. 44% $\frac{11}{25}$ | 12. 5% $\frac{1}{20}$ |
| 13. 15% $\frac{3}{20}$ | 14. 32% $\frac{8}{25}$ | 15. 100% 1 | 16. 1% $\frac{1}{100}$ |
| 17. 1000% 10 | 18. 68% $\frac{17}{25}$ | 19. 6.5% $\frac{13}{200}$ | 20. 8.4% $\frac{21}{250}$ |
| 21. 50% $\frac{1}{2}$ | 22. 112% $1\frac{3}{25}$ | 23. $3\frac{1}{3}\%$ $\frac{1}{30}$ | 24. 40% $\frac{2}{5}$ |
| 25. 150% $1\frac{1}{2}$ | 26. 82% $\frac{41}{50}$ | 27. 0.01% $\frac{1}{10000}$ | 28. 0.5% $\frac{1}{200}$ |
| 29. $9\frac{1}{4}\%$ $\frac{37}{400}$ | 30. 8% $\frac{2}{25}$ | 31. $83\frac{1}{3}\%$ $\frac{5}{6}$ | 32. 6.25% $\frac{1}{16}$ |



$$33\frac{1}{3}\% = ?$$

$$\begin{aligned} \frac{33\frac{1}{3}}{100} &= 33\frac{1}{3} \div 100 \\ &= 33\frac{1}{3} \times \frac{1}{100} \\ &= \frac{100}{3} \times \frac{1}{100} \\ &= \frac{1}{3} \end{aligned}$$

DEVELOPMENT AND EXERCISES

STRAND: Rate, Ratio & Percent LEVEL: 7
 UNIT: IV OBJECTIVE NUMBER: 7
 OBJECTIVE: *Convert decimals to percent.

SUGGESTED DEVELOPMENT: 1. Review percent. A percent is a fraction whose denominator is 100. This denominator is not written, but is replaced by the symbol %.

$$\text{e.g. } \frac{25}{100} = 25\% \qquad \frac{137}{100} = 137\%$$

2. Review multiplication of a decimal by 10, 1000, etc. (powers of 10). Lead class to the rule "move the decimal one place to the right for each "0" in the multiplier".

3. First approach using one and two decimal numbers.

e.g.	0.3	e.g.	0.37	METHOD
	$= \frac{3}{10}$		$= \frac{37}{100}$	Convert decimal to fraction.
	$= \frac{30}{100}$		$= \frac{37}{100}$	Change fraction to equivalent fraction with denominator of 100, if necessary.
	$= 30\%$		$= 37\%$	Read percent.

4. e.g.	0.764	e.g.	0.7649	METHOD
	$\frac{0.764}{1} = \frac{x}{100}$		$\frac{0.7649}{1} = \frac{x}{100}$	Develop ratio.
$0.764 \times 100 = x$		$0.7649 \times 100 = x$		Definition of equivalence.
$76.4 = x$		$76.49 = x$		Use multiplier rule.
76.4%		76.49%		State as percent.

5. Alternate Approach

$$0.764 = 0.764 \times \frac{100}{100} = \frac{0.764 \times 100}{100} = \frac{76.4}{100} = 76.4\%$$

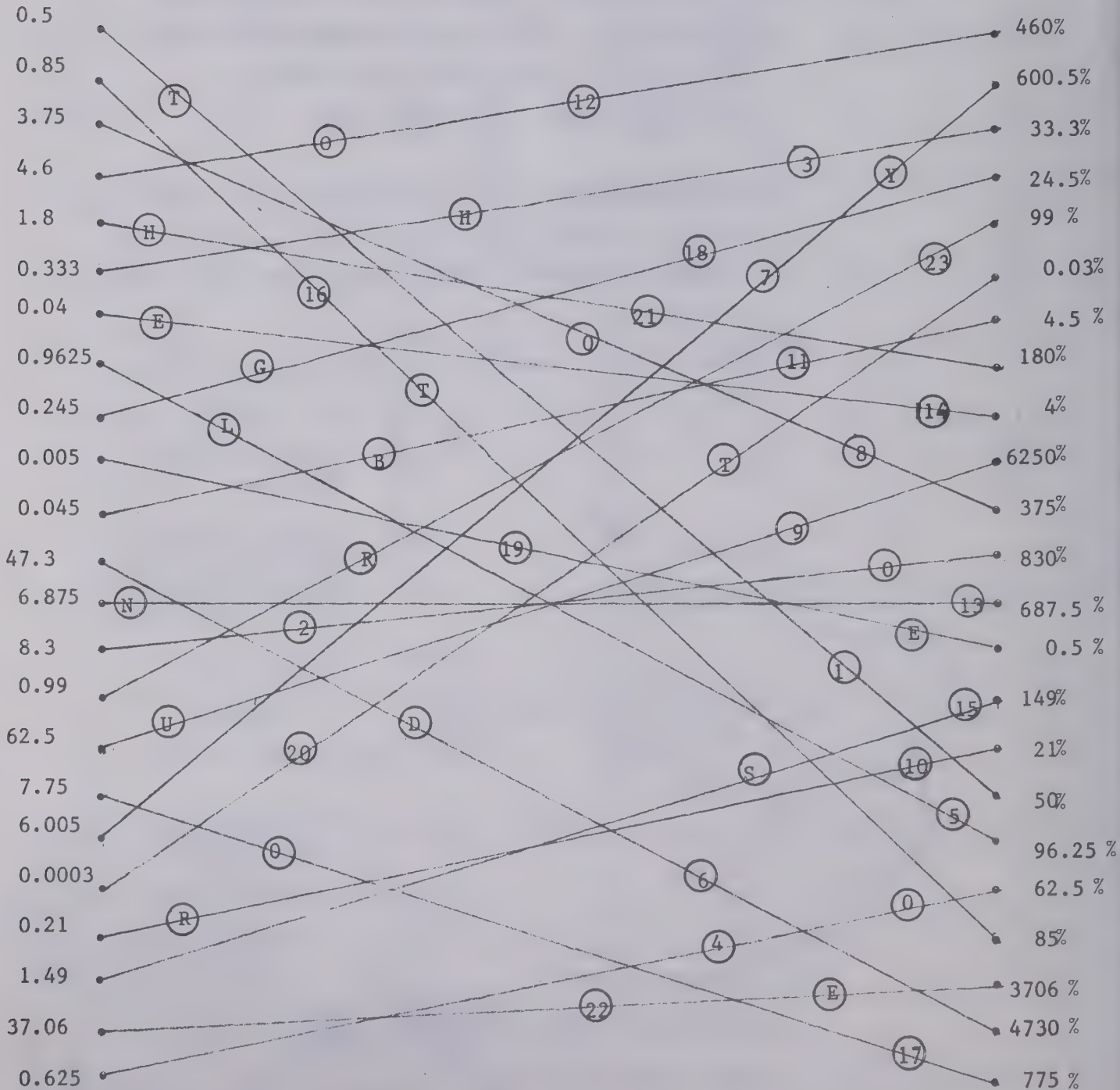
Rule: More decimals 2 places to the RIGHT; affix % sign.

EXERCISES:

OBJECTIVE NO. 7

Draw a straight line connecting the decimal numbers at the left with the equivalent percent at the right. Each line will cross one letter and one number. The number tells you where to put the letter in the line of boxes at the bottom of the page. When you have finished you will have discovered

"WHAT IS THE MAIN PURPOSE OF THE HUMAN SKIN?"



T O H O L D Y O U R
 1 2 3 4 5 6 7 8 9 10

B O N E S I O G E T H E R
 11 12 13 14 15 16 17 18 19 20 21 22 23

DECIMALS & PERCENTS

DECIMALS \longrightarrow PERCENTS

CHANGE THE DECIMAL TO A
FRACTION, THEN CHANGE
THE FRACTION TO A PERCENT

TO CHANGE 0.36 TO A PERCENT -

$$0.36 = \frac{36}{100} = 36\%$$

$$\therefore 0.36 = 36\%$$

TO CHANGE 0.07 TO A PERCENT -

$$0.07 = \frac{7}{100} = 7\%$$

$$\therefore 0.07 = 7\%$$

TO CHANGE 3.68 TO A PERCENT -

$$3.68 = 3 \frac{68}{100} = 368\%$$

$$\therefore 3.68 = 368\%$$

FRACTIONS, DECIMALS & PERCENTS

decimal	fraction	percent
0.36	_____	_____
0.52	_____	_____
_____	$\frac{163}{100}$	_____
_____	_____	25%
_____	$\frac{4}{100}$	_____
3.76	_____	_____
_____	_____	120%

DEVELOPMENT AND EXERCISES

STRAND:	<u>Rate, Ratio & Percent</u>	LEVEL:	<u>7</u>
UNIT:	<u>IV</u>	OBJECTIVE NUMBER:	<u>8</u>
OBJECTIVE:	<u>* Convert percent to decimals.</u>		

SUGGESTED DEVELOPMENT: 1. Use the following examples to illustrate the conversion of a percent to decimal. /

e.g. 157%

$$= \frac{157}{100}$$

$$= 1.57$$

e.g. 9%

$$= \frac{9}{100}$$

$$= 0.09$$

METHOD

Convert percent to fraction - denominator is obviously 100. At this point division by 10, 100, 1000, etc. should be reviewed.

2. Discuss a more involved type.

e.g. $6 \frac{1}{2} \%$

$$= \frac{6.5}{100}$$

$$= 0.065$$

e.g. $3 \frac{1}{2} \%$

$$= \frac{3.5}{100}$$

$$= 0.035$$

Convert to fraction.

Convert to decimal.

3. Help the student see the following patterns:

- a) When converting decimal to percent, move the decimal point two places to the right and write the % symbol at the end.
- b) Rule: When converting percent to decimal, move the decimal point two places to the left and omit the % symbol.
- c) Abbreviate the definition of equivalent fractions when changing the fraction to one with a denominator of one hundred or to a decimal.

DECIMALS & PERCENTS

PERCENTS \longrightarrow DECIMALS

CHANGE THE PERCENT TO A
FRACTION, THEN CHANGE
THE FRACTION TO A DECIMAL

TO CHANGE 15% TO A DECIMAL -

$$15\% = \frac{15}{100} = 0.15$$

$$\therefore 15\% = 0.15$$

TO CHANGE 6% TO A DECIMAL -

$$6\% = \frac{6}{100} = 0.06$$

$$\therefore 6\% = 0.06$$

TO CHANGE 265% TO A DECIMAL -

$$265\% = \frac{265}{100} = 2 \frac{65}{100} = 2.65$$

$$\therefore 265\% = 2.65$$

PERCENTS → DECIMALS

CONVERT EACH OF THE FOLLOWING
TO DECIMALS

1. 16% =

2. 35% =

3. 4.5% =

4. 150% =

5. $12\frac{1}{2}\%$ =

EXERCISES:

OBJECTIVE NO. 8

I. DIRECTIONS: Express each percent as a decimal numeral.

Find your answer in the rectangle below and cross it out.

The boxes not crossed out will spell out the message.

$10\% = 0.10 \quad 228\% = 2.28 \quad 3.75\% = 0.0375 \quad 87\frac{1}{2}\% = 0.875$

$47.5\% = 0.475 \quad 75\% = 0.75 \quad 400\% = 4.0 \quad 100\% = 1.0$

$65\% = 0.65 \quad 25\% = 0.25 \quad 600\% = 6.0 \quad 33\frac{1}{3}\% = 0.\bar{3}$

$3\% = 0.03 \quad 62\frac{1}{2}\% = 0.625 \quad 6\frac{1}{2}\% = 0.065 \quad 5\% = 0.05$

$14\% = 0.14 \quad 8\% = 0.08 \quad 24.5\% = 0.245 \quad 12.5\% = 0.125$

$4.5\% = 0.045 \quad 0.01\% = 0.0001 \quad 7\frac{3}{4}\% = 0.0775 \quad 1\% = 0.01$

$135\% = 1.35$

HIDDEN MESSAGE

T 4	H 1.2	M 0.625	A 10	N 3.85	S 1.35	N 0.65	G 2.45
I 0.2	O 0.0775	N 6.5	O 0.75	F 0.3	G 3.0	I 1.25	E 6
I 0.045	S 65	F 0.3	A 0.10	F 0.03	U 875	L 0.5	P 0.0375
L 40	O 0.0075	P 0.14	R 0.475	F 2.028	H 0.125	S 5	U 0.3
U 0.875	S 0.08	S 0.228	P 0.375	S 0.0001	E 0.375	N 0.0625	S 2.28
N 0.065	G 0.245	B 0.25	L 0.05	S 6	E 0.135	A 1	A 0.01

H A N G I N G / I S / F U L L / O F
S U S P E N S E



II. Complete the following chart for each value in each column and decode the answer to the riddle.

1.	$\frac{1}{10}$	$\frac{10}{100}$	(l) 0.1	10%
2.	$\frac{1}{5}$	(n) $\frac{20}{100}$	0.2	20%
3.	$\frac{9}{10}$	$\frac{90}{100}$	(f) 0.9	90%
4.	(b) $\frac{4}{10}$	$\frac{40}{100}$	0.4	40%
5.	$\frac{7}{10}$	$\frac{70}{100}$	0.70	(t) 70%
6.	$\frac{1}{4}$	(x) $\frac{25}{100}$	0.25	25%
7.	$\frac{1}{2}$	(u) $\frac{50}{100}$	0.5	50%
8.	(q) $\frac{8}{10}$	$\frac{80}{100}$	(p) 0.8	80%
9.	$\frac{3}{4}$	$\frac{75}{100}$	0.75	(v) 75%
10.	(d) $\frac{12}{10}$	$\frac{120}{100}$	1.20	120%
11.	$\frac{1}{8}$	$\frac{12.5}{100}$	(g) 0.125	12.5%
12.	$\frac{13}{10}$	$\frac{130}{100}$	(h) 1.3	130%
13.	$\frac{5}{4}$	(n) $\frac{125}{100}$	1.25	125%
14.	$\frac{1}{3}$	$\frac{33\frac{1}{3}}{100}$	0. $\overline{3}$	(d) $33\frac{1}{3}\%$
15.	(i) $\frac{1}{6}$	$\frac{16.\overline{6}}{100}$	(s) 0. $\overline{16}$	$16\frac{2}{3}\%$
16.	$\frac{3}{8}$	$\frac{37.5}{100}$	0.375	(w) 37.5%
17.	$\frac{2}{3}$	(c) $\frac{66\frac{2}{3}}{100}$	0. $\overline{6}$	$66\frac{2}{3}\%$
18.	$\frac{15}{25}$	$\frac{60}{100}$	(e) 0.6	60%
19.	(m) $\frac{7}{8}$	$\frac{87.5}{100}$	0.875	87.5%
20.	$\frac{5}{6}$	(a) $\frac{83.\overline{3}}{100}$	0. $\overline{83}$	$83\frac{1}{3}\%$

WHAT ARE THE TWO METRIC INSECTS?

C E N T I M E T R E P E D E S
 $66\frac{2}{3}$ 0.6 $\frac{125}{100}$ 70% $\frac{1}{6}$ $\frac{7}{8}$ 0.6 70% $\frac{20}{100}$ 0.6 0.8 0.6 $33\frac{1}{3}\%$ 0.6 0. $\overline{16}$
100

AND

L I T R E B U G S
0.1 $\frac{1}{6}$ 70% $\frac{20}{100}$ 0.6 $\frac{2}{5}$ $\frac{50}{100}$ 0.125 0. $\overline{16}$



DEVELOPMENT AND EXERCISESSTRAND: Rate, Ratio & PercentLEVEL: 7UNIT: IVOBJECTIVE NUMBER: 9OBJECTIVE: * Solve problems involving percent.SUGGESTED DEVELOPMENT: 1. CLASS DISCUSSION:

Be sure class understands that the word "of", translated to mathematics, means "multiplication", and the word "is" means "equal to".

2. EXAMPLES AND SUGGESTED METHODS:(a) 14 is $n\%$ of 35

SOLUTION: $14 = \frac{n}{100} \times 35$

$$100 \times 14 = \frac{n}{100} \times 35 \times 100$$

$$1400 = n \times 35$$

$$\frac{1400}{35} = n$$

$$40 = n$$

(b) $n\%$ of 600 is 3

SOLUTION: $\frac{n}{100} \times 600 = 3$

$$100 \times \frac{n}{100} \times 600 = 3 \times 100$$

$$n \times 600 = 300$$

$$n = \frac{300}{600}$$

$$n = \frac{1}{2}$$

(c) 2% of 6400 is n

SOLUTION:

$$\frac{2}{100} \times 6400 = n$$

$$\frac{12\ 800}{100} = n$$

$$128 = n$$

(d) 37.5% of n is 572

SOLUTION:

$$\frac{37.5}{100} \times n = 572$$

$$100 \times \frac{37.5}{100} \times n = 572 \times 100$$

$$37.5 \times n = 57\ 200$$

$$n = \frac{57\ 200}{37.5}$$

$$n = 1525.\overline{3}$$

PERCENT PROBLEMS

5% OF 3200 IS n

$$\frac{5}{100} \times 3200 = n$$

$$\frac{16\ 000}{100} = n$$

$$160 = n$$

\therefore 5% OF 3200 IS 160

PERCENT PROBLEMS

$$62.5\% \text{ OF } n = 125$$

$$\frac{62.5}{100} \times n = 125$$

$$62.5 n = 125$$

$$n = \frac{125}{62.5}$$

$$n = 2$$

$$62.5\% \text{ OF } 2 \text{ IS } 125$$

PERCENT PROBLEMS

36 IS $n\%$ OF 108

$$36 = \frac{n}{100} \times 108$$

$$3600 = 108n$$

$$\frac{3600}{108} = n$$

$$33\frac{1}{3} = n$$

$$\therefore = 33\frac{1}{3}\%$$

36 IS $33\frac{1}{3}\%$ OF 108

PERCENT PROBLEMS

42 IS n% OF 56

35% OF 60 IS n

60 IS 45% OF n

I. Solve each of the following:

- | | | | |
|-------------------|------|---------------------|-------|
| 1) 48 is n% of 40 | 120% | 6) n% of 6.4 is 5.6 | 87.5% |
| 2) n% of 12 is 9 | 75% | 7) 90% of 56 is n | 50.4 |
| 3) 24 is n% of 30 | 80% | 8) 28% of n is 56 | 200 |
| 4) n% of 25 is 75 | 300% | 9) 120% of 60 is n | 72 |
| 5) 40% of 75 is n | 30 | 10) 27 is n% of 36 | 75% |

REMINDER

36 is n% of 144

$$36 = \frac{n}{100} \times 144$$

$$100 \times 36 = 100 \times \frac{n}{100} \times 144$$

$$3600 = n \times 144$$

$$\frac{3600}{144} = n$$

$$25\% = n$$

II. Solve using proper problem procedures:

1. **Introductory Sentence:** Explain the variable.
2. **Translation:** Mathematical sentence.
3. **Solution of Math sentence.**
4. **Answer as a statement.**

1. Of a class of 32 pupils, 4 were absent on Friday. This is what percent of the class? 12.5%
2. On an exam Brian did 16 of 20 problems correctly.
 - (a) What percent did he do correctly? 80%
 - (b) What percent did he get wrong? 20%
3. Bob purchased a book that had been priced at \$3.50 for the reduced price of \$2.80. The reduction was what percent of the original price? 20%
4. The basketball team won 10 of its 16 games. What percent of their games did they win? 62.5%
5. There are 172 pupils in the seventh grade at Leduc Junior High School. Of these, 43 are on the honor roll. What percent of the students in grade seven are on the honor roll? 25%
6. A boy on October 15 this year was 160 cm tall. Last year on October 15 he was 140 cm tall. What percent of his old height has he grown? $14\frac{2}{3}\%$
7. The speed limit was reduced from 90 kilometres per hour to 75 kilometres per hour. What was the percent reduction? $16\frac{2}{3}\%$
8. Our class shrunk from 32 students to 28. What percent remained? $87\frac{1}{2}\%$
9. In a grade seven class totalling 30, 18 are boys. What percent of the class are girls? 40%
10. We expected 80 boys would register for a camping trip. Actually 100 registered. What percent of our expected number actually registered? 125%
- *11. A girl is making a leather belt. She measured her waist to be 80 cm. If she allows 5% for the overlap, how long a piece of leather should she cut? 84 cm
12. After travelling 600 km we had covered 60% of our trip. How many kilometres will we travel in the whole trip? 1000 km

REVIEW EXERCISES:

OBJECTIVE NO. 1 - 9

I. Complete the following puzzle:

¹ 5	² 5		⁴ 8	⁷ 5		⁸ 4	⁹ 0
³ 0	0		⁵ 1	1		¹⁰ 2	0
	0		⁶ 6	4		¹¹ 7	0
¹⁴ 2		¹⁹ 2			¹² 1	2	2
¹⁵ 7	5	0		²² 7		¹³ 3	3
0		²⁰ 5	²¹ 2		²⁵ 3		
¹⁶ 4	¹⁸ 2		²³ 1	²⁴ 6	0		²⁷ 6
¹⁷ 6	5		²⁶ 3	2	4		8

DOWN

1. $\frac{1}{2} = \underline{50}\%$
2. $5 = \underline{500}\%$
4. $816\% = \underline{8.16}$ (decimal)
7. $5 \frac{7}{50} = \underline{514}\%$
8. $427.23 = \underline{\quad}\% \quad 42723\%$
9. $0.023 = \underline{2.3}\%$
12. $\frac{2}{200} = \underline{\frac{1}{100}}\% \quad 2104.6\%$
14. $21.046 = \underline{\quad}\%$
18. $\frac{1}{4} = \underline{25}\%$
19. $2 \frac{1}{20} = \underline{205}\%$
21. $2.13 = \underline{213}\%$
22. $\frac{49}{700} = \underline{7}\%$
24. $\frac{124}{200} = \underline{62}\%$
25. $3.04 = \underline{304}\%$
27. $\frac{17}{25} = \underline{68}\%$

ACROSS

1. $\frac{11}{20} = \underline{55}\%$
3. $0\% = \underline{.00}$
4. $\frac{17}{20} = \underline{85}\%$
5. $0.11 = \underline{11}\%$
6. $\frac{16}{25} = \underline{64}\%$
8. $\frac{2}{5} = \underline{40}\%$
10. $0.2 = \underline{20}\%$
11. $\frac{42}{60} = \underline{70}\%$
12. $1 \frac{11}{50} = \underline{122}\%$
13. $0.33 = \underline{33}\%$
15. $\frac{30}{20} = \underline{150}\%$
16. $\frac{21}{50} = \underline{42}\%$
17. $\frac{26}{40} = \underline{65}\%$
20. $\frac{26}{50} = \underline{52}\%$
22. $\frac{3\frac{1}{2}}{50} = \underline{7}\%$
23. $1 \frac{3}{5} = \underline{160}\%$
26. $324\% = \underline{3.24}$ (decimal)

II. Solve each of the following (use proper problem procedure):

1. 65 is what percent of 60? 108.3%
2. 112% of 6 is what number? 6.72
3. 435 is 60% of what number? 725
4. St. Albert has a population of 25 000. Edmonton has a population of 625 000. What percent is St. Albert's population of Edmonton's population? 4%
5. John purchased a book that has a regular price of \$5.00. He received a 40% discount. What did he pay for the book?
 $\$3.00$



LABS

LEVEL 7

UNIT V

MEASUREMENT

OBJECTIVE: *Estimate the measure of various objects using SI and check by measuring.*

SUGGESTED DEVELOPMENT FOR THE LAB APPROACH:

TIME: One hour maximum

CLASS ORGANIZATION:

Groups of three students

MATERIALS: Each group should have the following: instructions, as attached, pencil for recording observations, metre stick, a piece of cord or string at least 2 m long.

PREREQUISITE LEARNINGS:

The teacher should be sure that the class understands:

1. The meaning of armspan, i.e. the distance from the end of the middle finger on one hand to the end of the middle finger on the other hand when the person is standing with arms fully extended sideways.
2. How to measure the nearest centimetre.
3. How to measure one's armspan, using string and a metre stick.

PURPOSE: Estimate the measure of various objects using SI and check by measuring.

- METHOD:**
1. Estimate in centimetres the length of the armspan of each student in the group and record the estimate in the table below.
 2. Measure in centimetres the length of the armspan of each student and record the result (to the nearest cm).
 3. Subtract the two results and record the difference in the table.
 4. Estimate (in cm) the height of each student in the group and record the estimates.
 5. Measure in centimetres the height of each student and record the result (to the nearest cm).
 6. Subtract the two results and record the difference in the table.

Were these height estimates closer to the actual measurements than your estimates of the students' armspans were? _____

	Student A	Student B	Student C
Estimated armspan (in cm)			
Measured armspan (to nearest cm)			
Difference (in cm) between estimate and actual			
Estimated height (in cm)			
Measured height (to nearest cm)			
Difference (in cm) between estimate and actual			

7. What conclusions can you draw regarding how the length of one's armspan compares to his/her height?
8. If Debbie's armspan is 130 cm, how tall do you think she might be?
9. If Ken is 162 cm tall, how long do you think his armspan might be?
10. Convert your previous measurements to decimetres and metres.

	cm	dm	m
Measured armspan of Student A			
Measured armspan of Student B			
Measured armspan of Student C			
Measured height of Student A			
Measured height of Student B			
Measured height of Student C			

ACTIVITIES

LEVEL 7

UNIT V

MEASUREMENT

Treasure Hunt

PURPOSE: To demonstrate to the class the need for standardized units.

MATERIALS: Classroom or playground.

Prepare a sheet of directions (such as illustrated below) using non-standard units of measure. Choose 2 or 3 students to follow directions one by one as the class watches. Choose students who differ physically so that units used by each will differ. Discuss with the class the reason each found a different spot.

Follow directions carefully. Remember, the entire area is rigged with explosives.

1. From the door take 3 paces north.
2. Turn east, move 3 feet.
3. Turn north, move 3 cubits, 2 spans.
4. Turn east, move 5 paces.
5. Turn south, move 4 cubits.

YOU ARE GETTING CLOSE, but REMEMBER

THE DYNAMITE!

6. Turn west, move 3 spans, 2 digits.
7. Mark the spot.

Linus' Lines

PURPOSE: To provide practice in reading and drawing segments with a centimetre ruler.

MATERIALS: A centimetre ruler at least 20 cm long, students sheets (illustrated below) and a deck of 50 cards labeled as below. (Be sure the unit, cm or mm, is indicated on each card).

RULES: (2 to 4 players)

1. Each player needs a game sheet and a metric ruler.
2. To begin play, each player draws a card at random and the greatest length indicates player one. Play rotates clockwise.
3. A play consists of drawing a card and constructing a segment equal to the length indicated on the card. The first segment must start from the end of Linus' pointing finger, going in any direction. Successive segments must start at the end of the last segment constructed, going in any direction. Player keeps the cards unless it is Linus' card. When drawn these cards are returned to the deck and the deck is shuffled.
4. The object of the game is to end a segment within Circle 1, then continuing the segments to Circles 2, 3, and 4. The first player to end a segment within Circle 4 wins the game.
5. A segment may not pass completely through any circle.
6. Players drawing a Linus' card must follow the directions, construct his segment and return the card to the deck and shuffle.

LINUS' DECK:

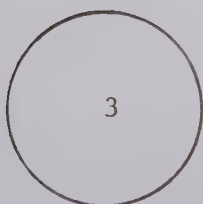
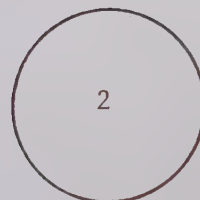
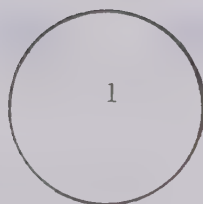
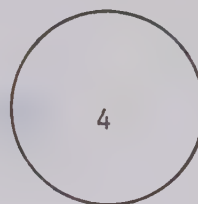
0.6 cm	6.0 cm	12.0 cm	130 mm + 20 mm
1.0 cm	6.3 cm	124 mm	14 cm + 0.6 cm
1.3 cm	70 mm	13.0 cm	4.7 cm + 15.0 cm
2.0 cm	7.6 cm	136 mm	12.2 cm - 7.1 cm
2.2 cm	8.0 cm	14.0 cm	98 mm - 39 mm
3.0 cm	82 mm	14.1 cm	11.3 cm - 8.1 cm
38 mm	9.0 cm	150 mm	14.9 cm - 1.1 cm
4.0 cm	9.9 cm	13 cm + 6 cm	11.7 cm + 2 cm
4.5 cm	100 mm	152 mm + 14 mm	140 mm + 3 cm
50 mm	105 mm	5.6 cm + 5.3 cm	
5.1 cm	11.0 cm	3.1 cm + 0.7 cm	
	11.7 cm	60 mm + 25 mm	

(Cont'd)

LINUS' CARDS: On 6 cards write, "LINUS' CARD" at the top and "RETURN THIS CARD TO THE DECK AND SHUFFLE THE DECK" at the bottom. In the middle, write each of the following instructions on two cards.

1. Measure the distance you need (use 1 or 2 cards from your discard pile to make your segments).
2. Estimate the distance you need. (Construct your estimate).
3. Use either the largest or the smallest card in your discard pile.

Game Board



APPLICATIONS

LEVEL 7

UNIT V

MEASUREMENT

BIBLIOGRAPHY FOR APPLICATIONS KIT

- Adler, Irving, Readings in Mathematics Book 1, Ginn and Co., Toronto, 1972
- Adler, Irving, Readings in Mathematics Book 2, Ginn and Co., Toronto, 1972
- Fadiman, Clyton, Fantasia Mathematica, Simon and Schuster, New York, 1958
- Friebel & Gingrich, Math Applications Kit, SRA, Toronto, 1971
- Horne, Sylvia, Patterns and Puzzles in Mathematics, Franklin Publications, Chicago, 1968
- Jacobs, Harold R., Mathematics a Human Endeavor, W. H. Freeman and Co., San Francisco, 1970
- Johnson, et al, Applications in Mathematics course A Scotts Foresman, Glenview, Illinois, 1972
- Johnson, et al, Applications in Mathematics course B Scotts Foresman, Glenview, Illinois, 1974
- Lyng, Meconi, Lwick, Career Mathematics: Industry and the Trades, Houghton Mifflin, Boston, 1974
- Schor, Meng, Insights and Skills Parts 1, 2 and 3, Globe Book Co., New York 1973
- Stein, Practical Applications in Mathematics, Allyn and Bacon Inc., Boston, 1972
- Witherding, Margaret F., From Fingers to Computers, Franklin Publications Inc., Chicago, 1970

VIDEO TAPES

ETV Math Series produced in Ontario Tape #1 Part D

Approximating & Estimations

Good for Grade 8 Measurement Applications

Tape #3 Part B

So You Want to Buy a Car

(Application in credit buying Grade 9 level)

Tape #5 Part A

Art from Computers

Useful as maxirational unit for applying Math to Art any grade level.

LEVEL 7

UNIT V

Reference
Section

OBJECTIVES

Measurement

Students should be able to:

1. Explain measurement as a comparison to some unit.
2. State reasons as to why a standardized system of measurement is necessary.
3. Express measurements correctly by including the numeral and unit.
4. List the SI prefixes and explain what they mean, as well as the mathematical relationship that exists between each. (Limit: mm, cm, dm, m, dam, hm, km)
5. Convert SI units of length from one unit to another. (Limit: mm, cm, m, km,)
6. Measure objects accurately using the SI units of length. (Limit: mm, cm, m)
7. Estimate the measure of various objects using the SI system and check by measuring.
8. Perform operations of addition and subtraction with SI units of measure.
9. Solve problems involving measurement.
- *10. Write the standard units of mass and capacity in SI and use SI prefixes to generate larger and smaller units.

A

C

B

C

MEASUREMENT APPLICATIONS (7)

UNIT V

A. Equipment:

City Map.

Provincial Map.

Map of Canada.

Rate schedule from a Moving Company.

1. (a) How many times has your family moved?

(b) How far each time?

(c) What was each cost?
2. (a) Find how a Mover determines a charge.

(b) How much will it cost to move across the city?

(c) How much will it cost to move to from Calgary?

(d) How much will it cost to move to Ottawa?

(e) How much will it cost to move to Vancouver?

(f) How much will it cost to move to P. E. I.?
3. Make a list of heavy items in your house. Would it be better to sell here and buy there?
4. Would it be cheaper to rent a truck and move yourself? Why do people not do this more frequently?

E. Additional Applications for Grade Seven Measurement

1. S.R.A. Applications Kit.

- (a) Science #26. "How can you make a musical scale?"
- (b) Everyday Things #28. "How long is a low note?"
- (c) Science #9. "How far do birds migrate?"
- (d) Science #10. "How far does a salmon have to swim?"
- (e) Science #44. "How does a mirror look?"

2. The following publications provide information on various aspects of the metric system:

- (1) Canada's Approach to the Metric System.
- (2) How to Write and Type SI - A Style Guide
- (3) Canada Prepares for Metric Conversion.
- (4) Why SI.
- (5) Introduction to the Metric System.

All of the above are available free of charge from:

Metric Commission




Box 4000

Ottawa, Ontario

K1H 9B8

C.

1. Complete the chart.

1 mg	1 g	1 kg	1 mg or 1 t
_____ kg	_____ kg		_____ kg
_____ hg	_____ hg	_____ hg	_____ hg
_____ dag	_____ dag	_____ dag	_____ dag
_____ g		_____ g	_____ g
_____ dg	_____ dg	_____ dg	_____ dg
_____ cg	_____ cg	_____ cg	_____ cg
	_____ mg	_____ mg	_____ mg

2. Complete the chart.

1 ml	1 cl	1 dl	1 l	1 dal	1 hl	1 kl
_____ kl	_____ kl	_____ kl	_____ kl	_____ kl	_____ kl	
_____ hl	_____ hl	_____ hl	_____ hl	_____ hl		_____ hl
_____ dal	_____ dal	_____ dal	_____ dal		_____ dal	_____ dal
_____ l	_____ l	_____ l		_____ l	_____ l	_____ l
_____ dl	_____ dl		_____ dl	_____ dl	_____ dl	_____ dl
_____ cl		_____ cl	_____ cl	_____ cl	_____ cl	_____ cl
	_____ ml	_____ ml	_____ ml	_____ ml	_____ ml	_____ ml

HISTORY

LEVEL 7

UNIT V

MEASUREMENT

REFERENCES

The Committee recommends the following references as primary sources of information for Junior High School teachers and students. We suggest that those books labelled (T) be available as teacher references and those labelled (S) be available in quantities of 3 - 5 for class use. Many of these books may be in your library now and extra copies may be borrowed from the Library Service Centre.

These references are numbered (1 - 14) for referral in the following outline:

1. Adler, Irving. The Giant Golden Book of Mathematics. Golden Press, New York, 1966
510 Ad 59g (S)
2. Adler, Irving. Readings in Mathematics (book 1). Ginn and Company, Lexington, Massachusetts, 1972.
510 Ad 59r (S)
3. Adler, Irving. Readings in Mathematics (book 2). Ginn and Company, Lexington, Massachusetts, 1972.
510 Ad 59r (S)
4. Bell, E.T. Men of Mathematics. Simon and Schuster, New York, 1966.
920 B 4134 (T)
5. Bergamini, David. Mathematics (Life Science Library). Time Inc., New York, 1966.
510 B 452 (T) and (S)
6. Denholm, Richard A. Mathematics: Man's Key to Progress (Book A) Franklin Publications Inc., Chicago, 1970.
(S)
7. Denholm, Richard A. Mathematics: Man's Key to Progress (Book B) Franklin Publications Inc., Chicago, 1970.
(S)
8. Halacy, Dan. Charles Babbage: Father of the Computer. Crowell-Collier Press, Toronto, Ontario, 1970.
921 B 113h (T) or (S)

9. Hogben, Lancelot. The Wonderful World of Mathematics. Doubleday and Company, Inc., Garden City, N.Y. 1955
510 H 679 (S)
10. Muir, Hane. Of Men and Numbers. Dodd, Mead and Co., New York, 1963
920 M 896 (S)
11. Ripley, R.D. and Tait, George, E. Mathematics Enrichment. Copp Clark Publishing Company, Toronto, 1966
(S)
12. Rogers, James T. Story of Mathematics for Young People. Pantheon Books, Random House Inc., Toronto, 1966.
510.09 R 632 (S)
13. Shaw, H. Alan and Fuge, Keri. The Story of Mathematics. Fletcher and Son Ltd., Norwich, Great Britain, 1963.
510.09 S h 26 (S)
14. Terry, Leon. The Mathmen. McGraw-Hill, New York, 1964.
510.09 T 279 (S)

SUPPLEMENTARY REFERENCES

(These are additional references for teachers)

Fadiman, Clifton, Fantasia Mathematics, Simon and Schuster, New York, 1958.

James & James, Mathematics Dictionary, 3rd ed., D. Van Nostrand Company, Inc., Toronto, 1968.

519 King, Amy C. and Read, Cecil B. Pathways to Probability, Holt,
K58 Rinehart and Winston, Inc., New York, 1963.

Marks, Robert W. The New Mathematics Dictionary and Handbook.
Bantam Books, Inc., New York, 1964.

512 N.C.T.M. Historical Topics in Algebra. National Council of
N213 Teachers of Mathematics, Washington, D.C., 1971.

Newman, James R. The World of Mathematics. (Vol. 1, 2, 3, 4)
Simon and Schuster, New York, 1956.

Smith, D.E. History of Mathematics. (Vol. 1,2) Dover
Publications, Inc., New York, 1958.

920 Turnbull, H.W. The Great Mathematicians. New York University
T849 Press, New York, 1969.

Black, Gerald J. Canada Goes Metric. Doubleday Canada Ltd.,
Toronto, 1974.

Posters

1. Walch, J.W. (Publisher) "Posters on Famous Mathematics".
Available on loan from the Library Service Centre.
2. I.B.M., Timeline "Men of Mathematics", available from I.B.M.
Library, Calgary. Ask for Item #5050003. (Free)

Busts

"Mathematicians of the Century", available from Moyer. Available
on loan from the Library Service Centre. (Price \$48.00)

Movies

CK "Possibly So Pythagoras". Available on loan from Instructional
10591 Aids Department.

CK "Donald Duck in Math Magic Land". Instructional Aids.
538

Games

1. Euclid. Western Educational Activities. For advanced students.

The resource list on Posters, Busts, Movies and Games was taken from Men of Mathematics - A Resource Unit developed by J. Barnes.

E. T. V. Math Series (Produced in Ontario). Available from Central Office.

Tape #3 part (a) Square Root: Newton's Method. (Time 20 min., 275 ft.)

Useful for introducing square roots in grades 8 or 9.

Tape #5 part (b) History of Computers.

Useful as a motivational unit.

Tape #5 part (f) Number Systems.

Useful for introducing number theory, grade 7.

Tape #6 part (a) History of Numerals

Useful in grade 7 whole numbers.

Tape #6 part (b) History of π .

Grade 9 geometry.

Tape #6 part (c) From Time to Time

Development of calendar.

Tape #6 part (f) History of India(n) Mathematics

Laid the basis for our present number system and useful in History of Math in an option.

Tape #7 part (a) Inverse Variation

Grade 9 functions.

Tape #7 part (b) Graphs

Grade 8 coordinate system (Descarte).

Tape #9 part (a) Fibonacci Sequence

Grade 8 real numbers.

Tape #9 part (b) The Divine Proportion: Golden Section

Grade 9 geometry.

Tape #9 part (c) Map Making

Useful for upper ability students in grade 9 solid geometry.

Tape #10 part (c) What are Numbers

History of development of number systems. Useful as an introduction to grade 7 number systems.

<u>LEVEL 7</u>	<u>MEASUREMENT</u>	<u>Reference</u>
<u>OBJECTIVES</u>	<u>UNIT V</u>	<u>Activities</u>
Students should be able to:		
1. Explain measurement as a comparison to some unit.		2
2. State reasons as to why a standardized system of measurement is necessary.		1, 3, 4,
3. Express measurements correctly by including the numeral and unit.		6
4. List the SI prefixes and explain what they mean, as well as the mathematical relationship that exists between each. (Limit: mm, cm, dm, m, dam, hm, km)		4
5. Convert SI units of length from one unit to another. (Limit: mm, cm, m, km,)		
6. Measure objects accurately using the SI units of length. (Limit: mm, cm, m)		
7. Estimate the measure of various objects using the SI system and check by measuring.		
8. Perform operations of addition and subtraction with SI units of measure.		
9. Solve problems involving measurement.		
*10. Write the standard units of mass and capacity in SI and use SI prefixes to generate larger and smaller units.		

UNIT V

MEASUREMENT (7)

RESOURCES

Early Egyptians began the use of standard units of measure.

Reference #1, Page 14

Reference #6, Pages 17-20

History of the Metric System - Reference:

Canada Goes Metric by Gerald J. Black

Published by Doubleday Canada Ltd., Toronto, 1974.

UNIT V

MEASUREMENT (7)

ACTIVITIES

1. Why would an Egyptian carpenter never lose his ruler?
2. Make a diagram showing units of Egyptian measure.
3. Why did it become necessary to have "standard units"?
4. Where and when was the metric system first adopted? What was the system based on?
5. Why is Canada going metric? Give two reasons.
6. Make a chart showing the linear units of measure.

Reference #1, pages 14-15 Giant Book of Mathematics

Additional reference: Canada Goes Metric by Gerald J. Black.

LEARNING

PACKAGE

LEVEL 7

UNIT V

MEASUREMENT

UNIT V - MEASUREMENT

PERFORMANCE OBJECTIVES

Students should be able to:

1. Explain measurement as a comparison to some unit.
2. State reasons as to why a standardized system of measurement is necessary.
3. Express measurements correctly by including the numeral and unit.
4. List the SI prefixes and explain what they mean, as well as the mathematical relationship that exists between each. (Limit: mm, cm, dm, m, dam, hm, km)
5. Convert SI units of length from one unit to another. (Limit: mm, cm, m, km)
6. Measure objects accurately using the SI units of length.
(Limit: mm, cm, m).
7. Estimate the measure of various objects using the SI system and check by measuring.
8. Perform operations of addition and subtraction with SI units of measure.
9. Solve problems involving measurement.
- *10. Write the standard units of mass and capacity in SI and use SI prefixes to generate larger and smaller units.

DEVELOPMENT AND EXERCISES

STRAND:	<u>Measurement</u>	LEVEL:	<u>7</u>
UNIT:	<u>V</u>	OBJECTIVE NUMBER:	<u>1, 2, & 3</u>
OBJECTIVE:	<u>1) Explain measurement as a comparison to some unit.</u>		
	<u>2) State reasons as to why a standardized system of measurement is necessary.</u>		
	<u>3) Express measurements correctly by including the numeral and unit.</u>		

SUGGESTED DEVELOPMENT: I. CLASS DISCUSSION

- (i) Institute a class discussion of measurement.
- (ii) Lead class to conclusions about
 - measurement as comparison
 - standardized units
- (iii) Assign selected exercises on measurement as comparison and standardized units.

A. Why measurement

- (i) Past, present, and future types of measurement.
- (ii) Measurement and you
 - farm chores (how much feed, when to milk cows)
 - morning routine (how much cereal, when did alarm go off)
- (iii) Measurement and industry.
 - assembly production (components)
 - manufacture (garment industry)
- (iv) Transportation.
 - speeds
 - measure of fuel
 - distances

B. Measurement as a comparison

- (i) Physical parts of the body.
 - cubit, span, palm, digit, foot, pace
 - scale measurement, i.e. maps

C. Standardized Systems

- (i) Assume no standardized measurement exists, discuss:
 - commerce
 - construction industry
 - mass production
 - sports

II. CLASS DISCUSSION

- (i) Discuss with the students the importance of correct notation as a measure of the same length may be expressed in different units.
eg. (i) 45 cm may be expressed as .45 m
or 4.5 dm or 450 mm.

III. CLASS LAB APPROACH

- (i) Discuss with the students the following early units of measure:
 - Cubit: the distance from the point of the elbow to the tip of the middle finger.
 - Foot: the length of a person's foot.
 - Span: the distance from the tip of the thumb to the tip of the little finger when the fingers are spread out.
 - Palm: width of four fingers held together.
 - Digit: the width of the index finger or middle finger.
- (ii) Divide the class into groups of 3 or 4 students and have them complete the lab.
- (iii) Make a chart on the board to record the results of the groups.
- (iv) Discuss conclusions of students with respect to:
 - measurement as a comparison
 - standardized units
- (v) Assign selected exercises.

EXERCISES:OBJECTIVE NO. 1, 2 & 3MEASUREMENT LAB

I. 1. Have each member of your group measure the width of a desk in spans and digits. Record your results.

2. Have each member measure the width of the classroom in feet (use your own). Record your results.

3. Have each member find the length of the chalkboard in cubits. Record your results.

4. Do all the results in your group agree? Why not? How could your results be more nearly the same?



II. 1. Measure the length and width of your desk without the use of any formal measuring device.

2. Describe the method you used and your results.

3. Compare your results with the other members of your group. Did they use the same method? If not, what method did they use?

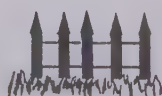
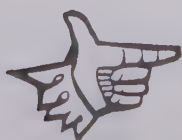
4. Measure your desk again but use the other persons' method. Do your results agree?

5. What similarity exists in the two methods you used?

III. Mr. Jones wishes to build a picket fence. He needs 165 pickets and by using his hand discovers that each picket is to be six spans and three digits long. To save time he asks eleven of his friends to measure fifteen pickets each and cut them that length.

1. Describe the fence if Mr. Jones builds it using the pickets made by his eleven friends.

2. How could Mr. Jones use the pickets cut by his friends to create a pleasing fence?



DEVELOPMENT AND EXERCISES

STRAND: Measurement

LEVEL: 7

UNIT: V

OBJECTIVE NUMBER: 4

OBJECTIVE: List the SI prefixes and explain what they mean, as well as the mathematical relationship that exists between them.
(Limit: mm, cm, dm, m, dam, hm, km)

SUGGESTED DEVELOPMENT: I. (i) Discuss development of SI measurement.

- Standard unit metre.

a) $\frac{1}{40\,000\,000}$ of meridian of the earth
from north to south poles.

b) Standard metre marked on a bar of
platinum-iridium and kept at a
constant temperature and pressure.

c) 1 650 763.73 wavelengths of radia-
tion from krypton 86 atom.

NOTE: Symbols are not abbreviations.

- no period

- all lower case letters

NOTE: Spelling - metre not meter
to distinguish from measuring
instruments, such as water
meter, etc.

UNIT	SYMBOL	UNIT FAMILIARIZATION EXAMPLES	RELATIONSHIP TO 1 METRE
metre	m	(i) Metric Salute - approximation of one metre in adults. (ii) Newspaper - diagonal of an open newspaper is approximately one metre.	1 metre
decimetre	dm	UNITS SMALLER THAN A METRE (i) Hand - a student may determine a dimension of their hands which is approximately one decimetre.	0.1 metre
centimetre	cm	(ii) - average length of man's wallet. (i) Fingernail - the width of the fingernail on the little finger of an adult is approximately one centimetre.	0.01 metre
millimetre	mm	(ii) Chalk - the diameter of a piece of chalk is approximately one centimetre. (i) Toothpick - the thickness of a toothpick is approximately one millimetre. (ii) Dime - the thickness of a dime is approximately one millimetre. (iii) - the thickness of a paper clip. (iv) - the thickness of placing two fingers together without touching.	0.001 metre
decametre	dam	UNITS LARGER THAN A METRE (i) - ten persons side by side showing the metric salute will approximate a decametre. (ii) - height of giraffe. (iii) - length of ETS bus. (iv) - mark the length on the wall of the classroom.	10 metres
hectometre	hm	(i) - football field.	100 metres
kilometre	km	(ii) - CN Tower in Edmonton. (i) - smaller than a mile, approximately 8 city blocks. (ii) - length of 10 football fields.	1000metres

EXERCISES:

OBJECTIVE NO. 4

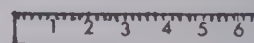
I. EQUIPMENT - METRE STICK

There are three measures of length in the metric system less than one metre. From smallest to largest these are:

- (i) millimetre (mm)
- (ii) centimetre (cm)
- (iii) decimetre (dm)

1. Examine the different markings on the metre stick. Look at the numbers carefully.
 - a) Between the digits, the different markings are arranged in groups of (10)?
 - b) Draw a line the length of which is equal to the largest subdivision on the metre stick.
 - c) How many of these units are there in a metre? (10)
 - d) What fraction of the metre stick is this unit? What is this fraction as a decimal? (0.1) ($\frac{1}{10}$)
 - e) What is the name of this unit? (decimetre)
2. Examine another unit on your metre stick that is about the same size as the width of your smallest finger.
 - a) Draw a line as long as this unit. (——)
 - b) Record the number of these units on the metre stick. (100)
 - c) What fraction of the metre stick is this unit? What decimal fraction? What is the name of this unit? ($\frac{1}{100}$) (0.01)
 - d) What number of these units make up a decimetre? (10)
 - e) What fraction of the decimetre is this unit? What decimal fraction? ($\frac{1}{10}$) (0.1)
3. Examine the smallest unit on your metre stick that is about the width of a toothpick.
 - a) Draw a line as long as this unit.
 - b) How many of these units are there in a metre? What is the name of this unit? (1000) (millimetre)
 - c) How many of these units are there in each of the other units?
decimetre, centimetre.
(100) (10)
 - d) What fraction and decimal fraction is this unit of each of the following: (Draw the table in your assignment book.)

UNIT	FRACTION	DECIMAL
metre	$\frac{1}{1000}$	0.001
decimetre	$\frac{1}{100}$	0.01
centimetre	$\frac{1}{10}$	0.1
4. Complete the following statements. As the units in the metric system increase in size, each unit is
 - a) 10 times as large as the one below it.
 - b) 1000 millimetres equal one metre.
 - c) 100 centimetres equal one metre.
 - d) 10 decimetres equal one metre.
 - e) 100 millimetres equal one decimetre.
 - f) 10 centimetres equal one decimetre.
 - g) 10 millimetres equal one centimetre.



SI LINEAR RELATIONSHIPS

UNIT	SYMBOL	EQUIVALENT METRES
*KILOMETRE	km	1000 m
HECTOMETRE	hm	100 m
DECAMETRE	dam	10 m
*METRE	m	1 m
DECIMETRE	dm	0.1 m
*CENTIMETRE	cm	0.01 m
*MILLIMETRE	mm	0.001 m
*INDICATES PREFERRED UNITS		

DEVELOPMENT AND EXERCISES

STRAND: Measurement

LEVEL: 7

UNIT: V

OBJECTIVE NUMBER: 5

OBJECTIVE: Convert SI units of length from one unit to another.
(Limit: mm, cm, m, km)

- NOTE: - require correct symbolism and notation.
 - 12345 cm is expressed as 12 345 cm (space between groups of three digits from the decimal).
 - emphasize preferred units. (mm, m, km).

- SUGGESTED DEVELOPMENT: (i) Study the chart below.
 (ii) Prepare or have students prepare the metric conversion table.
 (iii) Assign selected exercises with emphasis on preferred units.
 (iv) Discuss use of preferred units (mm, m, km).
 - use whole numbers wherever possible
 eg. 50 mm instead of 0.05 m

NOTE: 10 mm = 1 cm
 10 cm = 1 dm
 10 dm = 1 m
 10 m = 1 dam
 10 dam = 1 km
 10 km = 1 km

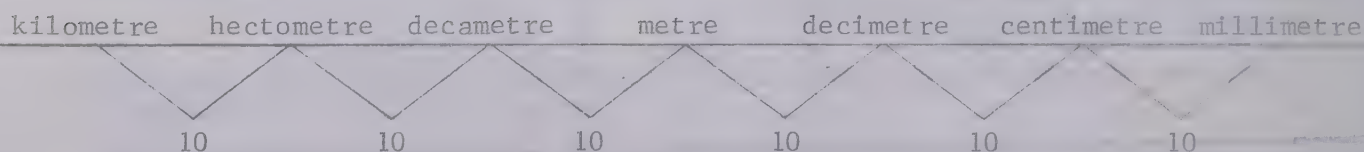
NOTE: milli means $\frac{1}{1000}$ of
 0.001 of
 centi means $\frac{1}{100}$ of
 0.01 of
 deci means $\frac{1}{10}$ of
 0.1 of
 deca means 10 x
 hecto means 100 x
 kilo means 1000 x

NOTE: Centimetre unit is commonly used for clothing measurement and body measurement.

METRIC CONVERSION TABLE

Decrease in size
 Increase in number
 Multiply →

← Divide
 Increase in size
 Decrease in number



DIRECTIONS: 25 cm = _____ dam

- Place thumbs on units involved (cm and dam).
- As this is a decrease in number, divide by ten the number of times it appears between your thumbs - there are 3, so $25 \div (10 \times 10 \times 10) = 0.025$.
- To increase in number, multiply by the number of tens.

METRIC CONVERTER

INCREASE IN SIZE
DECREASE IN NUMBER

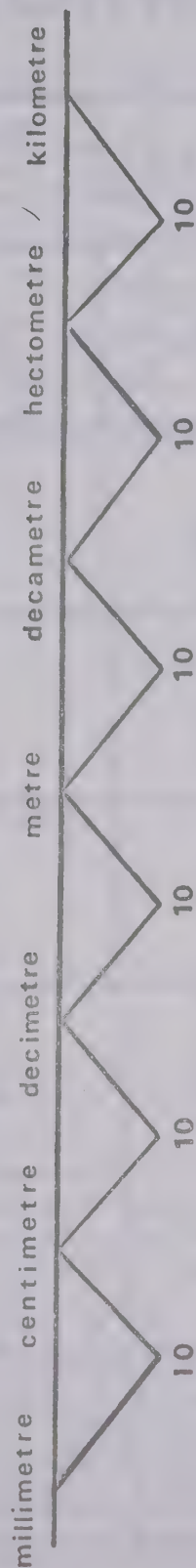


DIVIDE

DECREASE IN SIZE
INCREASE IN NUMBER



MULTIPLY



DIRECTIONS: 25 cm = dam

1. PLACE THUMBS ON UNITS INVOLVED (cm AND dam).

2. AS THIS IS A DECREASE IN NUMBER, DIVIDE BY TEN
THE NUMBER OF TIMES IT APPEARS BETWEEN YOUR
THUMBS - THERE ARE 3, SO $25 \div (10 \times 10 \times 10) = 0.025$.

3. TO INCREASE IN NUMBER, MULTIPLY BY THE NUMBER
OF TENS.

SI LINEAR RELATIONSHIPS

UNIT	SYMBOL	EQUIVALENT METRES
*KILOMETRE	km	1000 m
HECTOMETRE	hm	100 m
DECAMETRE	dam	10 m
*METRE	m	1 m
DECIMETRE	dm	0.1 m
*CENTIMETRE	cm	0.01 m
*MILLIMETRE	mm	0.001 m
*INDICATES PREFERRED UNITS		

EXERCISES:

OBJECTIVE NO. 5

I. Copy and complete the following chart.

1 mm =	1 cm =	1 dm =	1 m =	1 dam =	1 hm =	1 km =
10⁻¹ mm*	10 mm*	10² mm*	10³ mm*	10⁴ mm*	10⁵ mm*	10⁶ mm*
10⁻¹ cm*	10 cm*	10² cm*	10³ cm*	10⁴ cm*	10⁵ cm*	10⁶ cm*
10⁻² dm	10⁻¹ dm	10² dm	10³ dm	10⁴ dm	10⁵ dm	10⁶ dm
10⁻³ m*	10⁻² m*	10⁻¹ m*	10² m*	10³ m*	10⁴ m*	10⁵ m*
10⁻⁴ dam	10⁻³ dam	10⁻² dam	10⁻¹ dam	10² dam	10³ dam	10⁴ dam
10⁻⁵ hm	10⁻⁴ hm	10⁻³ hm	10⁻² hm	10⁻¹ hm	10² hm	10³ hm
10⁻⁶ km*	10⁻⁵ km*	10⁻⁴ km*	10⁻³ km*	10⁻² km*	10⁻¹ km*	10² km*

II. Convert each of the following to the indicated unit.

(Exponential notation used
in charts for convenience.
Use decimal notation
in class.)

- 1000 mm = 1 m
- 10 km = 10⁴ m *10000*
- 1000 m = 1 km
- 1 km = 10⁶ mm
- 100 cm = 1 m
- 1 km = 10⁵ cm
- 10 mm = 1 cm
- 1 m = 10 dm
- 10 km = 10⁷ mm
- 10 hm = 1 km
- 1000 m = 1 km
- 100 mm = 0.1 m
- 10 m = 0.01 km
- 1000 m = 10 hm
- 1000 mm = 1 m
- 1000 mm = 10 dm
- 0.1 m = 100 mm
- 0.1 km = 0.01 m
- 0.1 cm = 1 mm
- 10 cm = 10⁻⁴ km *0.0001*

III. Convert each of the following to the indicated unit:

- 200 cm = 2 m
- 5 000 m = 5 km
- 3 000 cm = 30 m
- 4 km = 4000 m
- 9 000 m = 9 km
- 100 m = 0.1 km
- 378 cm = 3.780 mm
- 46 982 cm = 0.46982 km
- 88 cm = 0.00088 km
- 0.382 dam = 0.00382 km
- 1 389 dm = 138 900 mm
- 1 843 m = 184.3 dam
- 592 cm = 5.92 m
- 592 mm = 0.592 m
- 76.243 dm = → km *0.007 624 3*
- 358.3 m = 35 830 cm
- 0.32 hm = 3 200 cm
- 20 dm = 2 m
- 0.1 hm = 10⁵ mm
- 0.008 km = 8 m

IV. a) Draw and complete the following chart.

b) Circle the preferred unit for the expression of the given length.

mm	cm	m	dam	km
620 000 cm	62 000 cm	620 m	62 dam	0.62 km
4 300 000	430 000	4 300	430	4.3 km
6 423 110	642 311 cm	6 423.11	642.311	6.423 11
1 428 000	142 800	1 428 m	142.8	1.428
62 341 mm	6 234.1	62.341	6.234 1	0.062 341
16 000	1 600	16 m	1.6	0.016
1 320	132 cm	1.32	0.132	0.001 32
4 320 000	432 000	4 320	432 dam	4.32
61 420 000	6 142 000	61 420	6 142	61.42 km

DEVELOPMENT AND EXERCISES

STRAND: Measurement

LEVEL: 7

UNIT: V

OBJECTIVE NO. 6

OBJECTIVE: Measure objects accurately using SI units of length.

(Limit: mm, cm, dm, m)

SUGGESTED EQUIPMENT:

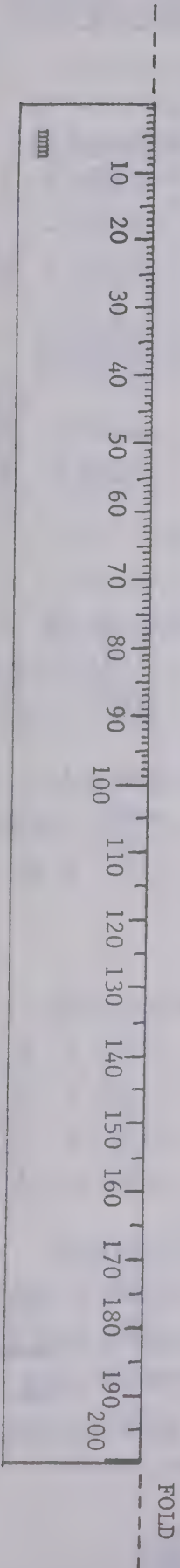
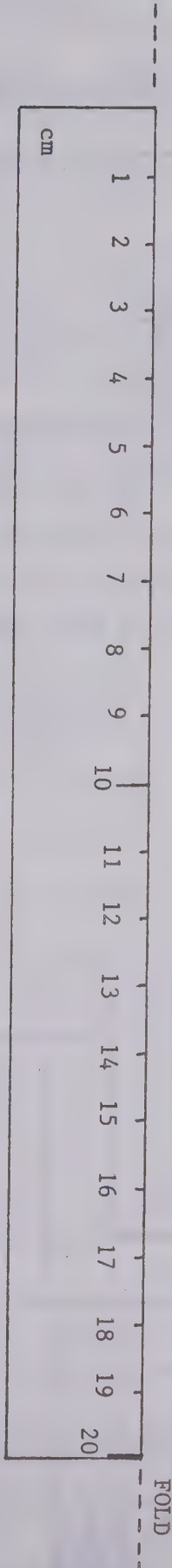
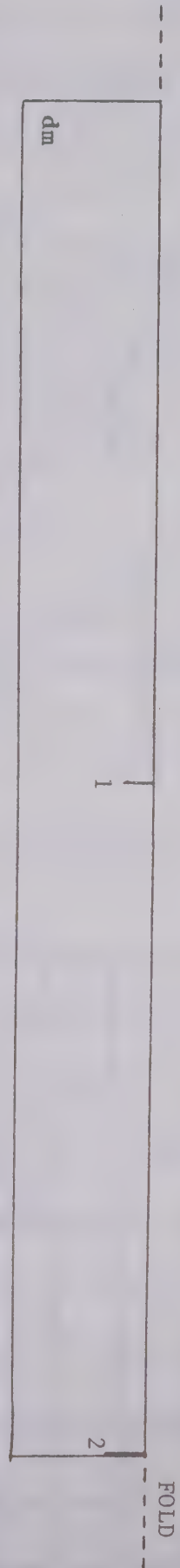
- metre ruler graduated in dm and cm only.
- metric ruler graduated in cm and mm
- duplicate Exercise #I for student use.

- SUGGESTED DEVELOPMENT: I. (i) Prepare or have students prepare sheet with decimetre scale, centimetre scale, and millimetre scale. Prepare transparency of scales for your own use.
- (ii) Measure segments on overhead projector using different scales for each to indicate measurement as approximation and precision depends on units.
- (iii) Discuss approximation and precision with students (scale used as an instrument).
- (iv) Assign selected exercises.

NOTE: $m(\overline{AC})$ reads measure of segment AC.

- II. (i) Have students do Lab 1 using metre sticks and metric rulers.
- (ii) Discuss findings as to use of different scales and precision.
- (iii) Assign selected exercises.
- III. (i) Discuss with the class the following topics as they refer to accuracy of measures and errors in measurement.
- Rounding off using different scales.
 - Large distances (Edmonton to Calgary in relation to Edmonton to St. Albert and Edmonton to London, England).
 - Use of different measuring instruments. (transit, micrometre, etc.) still produces error.

I.



METRIC RULER THREE

METRIC RULER TWO

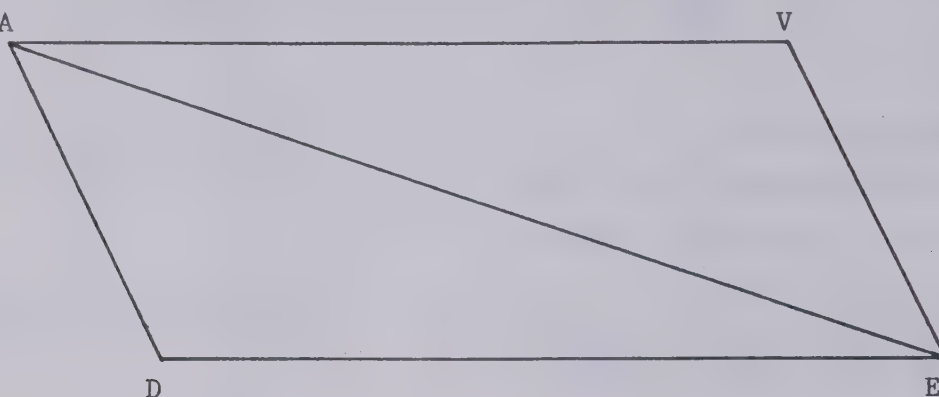
METRIC RULER ONE

EXERCISES:

OBJECTIVE NO. 6

Measure each of the following using the indicated ruler.

1. A

(a) Ruler #1

$$m(\overline{AV}) = \underline{1}$$

$$m(\overline{AE}) = \underline{1}$$

$$m(\overline{AD}) = \underline{0}$$

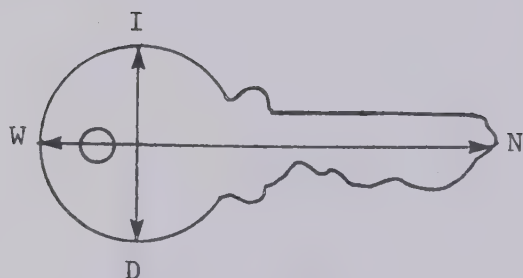
(b) Ruler #2

$$m(\overline{AV}) = \underline{10}$$

$$m(\overline{AE}) = \underline{13}$$

$$m(\overline{AD}) = \underline{5}$$

2.

(a) Ruler #2

$$m(\overline{WN}) = \underline{6}$$

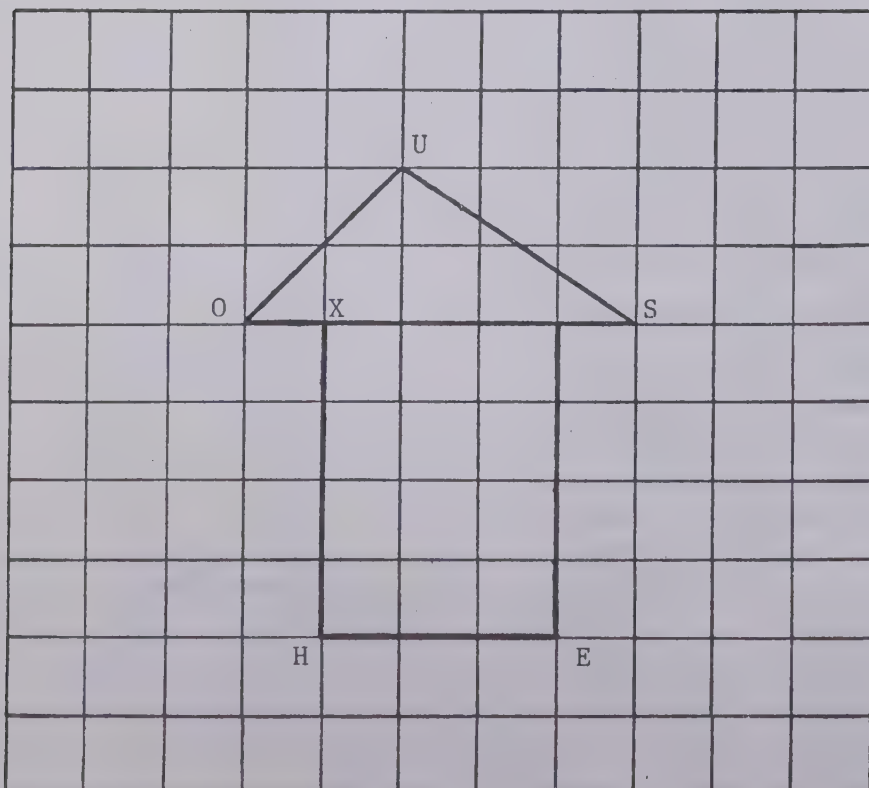
$$m(\overline{ID}) = \underline{3}$$

(b) Ruler #3

$$m(\overline{WN}) = \underline{58}$$

$$m(\overline{ID}) = \underline{25}$$

3.

(a) Ruler #2

$$m(\overline{HX}) = \underline{4}$$

$$m(\overline{OU}) = \underline{3}$$

$$m(\overline{US}) = \underline{4}$$

$$m(\overline{HE}) = \underline{3}$$

(b) Ruler #3

$$m(\overline{HX}) = \underline{40}$$

$$m(\overline{OU}) = \underline{28}$$

$$m(\overline{US}) = \underline{36}$$

$$m(\overline{HE}) = \underline{30}$$



EXERCISES:

OBJECTIVE NO. 6

II. EQUIPMENT - Metre stick graduated in: - decimetres only
- centimetres only

1. Measure each of the following. Use the scale graduated in decimetres only, and record your results in Table #1.

- a) Height of the doorway.
b) Length of your pace (heel to heel).
c) Your partner's height.
d) Width of the classroom.

TABLE #1

OBJECT	dm	cm
Height of doorway		
Length of your pace		
Your partner's height		
Width of the classroom		

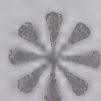
2. Remeasure each of the above using the scale graduated in centimetres only, and record the results in Table #1.

3. Convert the measures in Table #1 all to centimetres. Are any of the measures for which you used the decimetre scale the same as the measures for which you used the centimetre scale? Why?
4. Which ruler gave you a more precise measure? Why? (cm)
5. Is measurement exact with any of these rulers? (No)
6. Is any measuring instrument 100% accurate? (No)

III. EQUIPMENT - metric ruler or metre stick.

Measure each of the following segments in dm, cm, and mm.

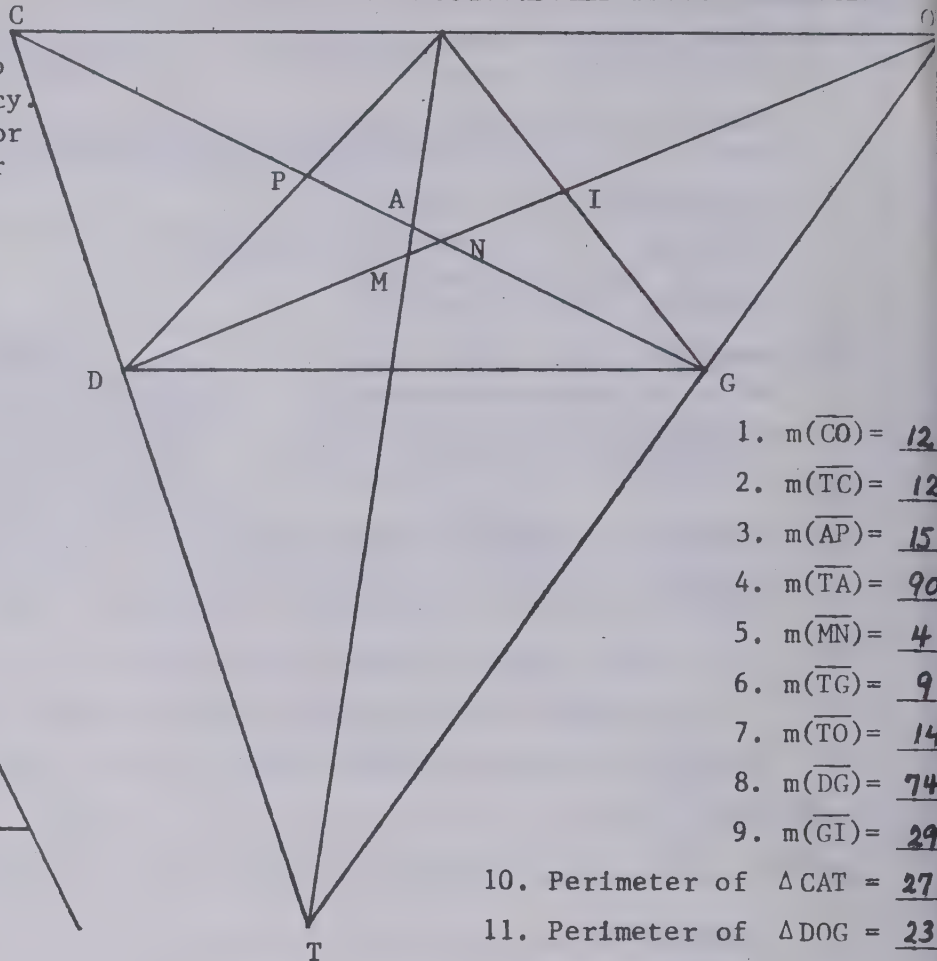
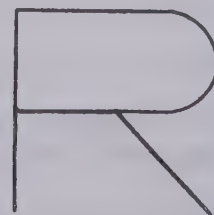
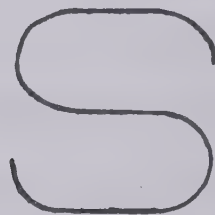
1. _____ 1 dm 11 cm 111 mm
2. _____
3. _____ (1, 7, 73) (2, 17, 168)
4. _____ (1, 10, 97)
5. _____ (1, 13, 127)
6. _____ (1, 14, 142)
7. _____
8. _____ (0, 3, 25) (2, 15, 154)
9. _____ (1, 10, 102)
10. _____ (1, 14, 141)
11. Which of the above segments have the same measure in decimetres?
In centimetres? (#6, 10) (*1, 3, 4, 5, 6, 9, 10) (2, 7)
12. Does this mean that these pairs of segments are the same length? (No)
Explain your answer. (Depends on size of the unit used for measuring.)



EXERCISES:

OBJECTIVE NO. 6

IV. Measure each of the following segments to the indicated accuracy. Give the solutions for the following in your assignment book.



1. $m(\overline{CO}) = \underline{12}$ m
2. $m(\overline{TC}) = \underline{12}$ m
3. $m(\overline{AP}) = \underline{15}$ m
4. $m(\overline{TA}) = \underline{90}$ m
5. $m(\overline{MN}) = \underline{4}$ m
6. $m(\overline{TG}) = \underline{9}$ m
7. $m(\overline{TO}) = \underline{14}$ m
8. $m(\overline{DG}) = \underline{74}$ m
9. $m(\overline{GI}) = \underline{29}$ m

10. Perimeter of $\triangle CAT = \underline{27}$ m
11. Perimeter of $\triangle DOG = \underline{23}$ m
12. Perimeter of $\triangle MAN = \underline{11}$ m

V. EQUIPMENT - Metric ruler

Find the measure of: (all in mm)

1. Total length of all segments of M is? (88)
2. Base of the first E is? (25)
3. Spine of the R is? (26)
4. Bar in the A is? (12)
5. Top of the second E is? (26)
6. Leg of the R is? (18)

DEVELOPMENT AND EXERCISES

STRAND:	<u>Measurement</u>	LEVEL:	<u>7</u>
UNIT	<u>V</u>	OBJECTIVE NO.	<u>7</u>
OBJECTIVE:	<u>Estimate the measure of various objects using SI and check by measuring.</u>		

SUGGESTED DEVELOPMENT: (i) Discuss the importance of estimation on measurement.

i.e. - all measurement is approximation even though it doesn't appear so.

- general descriptions are always estimations.

(ii) Have students estimate length of teacher's desk in various units (metre, centimetre).

(iii) Assign selected exercises.

EXERCISES:

OBJECTIVE NO. 7

- I. You and your partner should estimate (make a good guess) for the length of each of the following and check by measuring. The units you are to use are in the table. Copy and complete the chart.

LENGTH OF	YOUR ESTIMATE	YOUR PARTNER'S ESTIMATE	MEASURED LENGTH
a) desk	cm	cm	cm
b) door	m	m	m
c) pencil	cm	cm	cm
d) eraser	mm	mm	mm
e) window	cm	cm	cm
f) ledge on the blackboard	m	m	m
g) locker	cm	cm	cm
h) your partner's height	m	m	m
i) your teacher's height	m	m	m
j) bookshelf	cm	cm	cm
k) bulletin board	cm	cm	cm
l) blackboard eraser	cm	cm	cm
m)			
n)			
o)			

NOTE: m, n, and o, choose any object in the room.

- II. A. Estimate rather than measure the following segment lengths to the nearest whole unit suggested and check by measuring.

1. cm _____ (3)

2. mm _____

3. m _____

4. dam _____ (0)

- B. Estimate the diameter of the following circles to the nearest unit suggested.

3. m

2. cm

6

0

1. mm

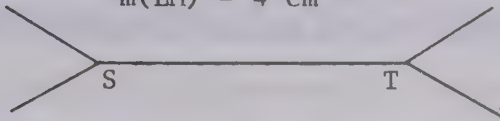
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EXERCISES:

OBJECTIVE NO. 7

II. C. 1) L _____ M

$$m(\overline{LM}) = 4 \text{ cm}$$



Using $m(\overline{LM})$ as a guide, (40)
estimate $m(\overline{ST})$ in mm.

2) X _____ Y

$$m(\overline{XY}) = 35 \text{ mm}$$



Using $m(\overline{XY})$ as a guide, (3)
estimate $m(\overline{AB})$ in cm.

- D. 1. What would be the measure of an ant's egg? (Estimates - in mm.)
 2. How long would a gopher be from head to tail? in cm
 3. How long is the High Level Bridge? in m
 4. Instead of a 25" TV screen, what would we now call it? (60 cm)

E. Estimate the length of each of the following in centimetres - check by measuring.

1. _____ (13)
2. _____ (6)
3. _____ (8)
4. _____ (16)
5. _____ (10)
6. _____ (5)
7. _____ (13)
8. _____ (8)
9. _____ (18)
10. _____ (3)

III. A. 1. Use your metre stick and name two common objects that are about:

- a) one metre in length eg. you could use:
 b) one decimetre in length (i) width of your finger
 c) one centimetre in length (ii) length of your book
 d) one millimetre in length

2. Estimate the length of other objects in the room that you have not measured. Then check by measuring. Copy and complete the chart.

	Estimate	Measure
1. Height of your desk		
2. Length of the room		
3. Width of your desk		
4. Your height		

- B. 1. Is the length of an open newspaper equal to, less than, or greater than a metre? Check by measuring. (Less than)
 2. You wish to mark out a one kilometre track in the gym. Estimate the number of times you would have to go around the gym to run one kilometre. Check by using a trundle wheel.

DEVELOPMENT AND EXERCISES

STRAND: Measurement

LEVEL: 7

UNIT: V

OBJECTIVE NO. 8

OBJECTIVE: Perform operations of addition and subtraction with SI units of
measure.

SUGGESTED DEVELOPMENT: (i) Review addition and subtraction of SI units
emphasizing the importance of common units.

(ii) Assign selected exercises.

EXERCISES:

OBJECTIVE NO. 8

I. Measure each of the following segments, use the indicated units, then find the sum or difference.

1. $\overline{RI} + \overline{CK} = \underline{13} \text{ (mm)}$

2. $\overline{DA} + \overline{VE} = \underline{104} \text{ mm}$

3. $\overline{JA} - \overline{CK} = \underline{6} \text{ cm}$

4. $\overline{JO} - \overline{AN} = \underline{2.9} \text{ cm}$

5. $\overline{MA} + \overline{RI} + \overline{ON} = \underline{32.2} \text{ mm}$

6. $\overline{MA} + \overline{RI} + \overline{ON} = \underline{32.2} \text{ mm}$

II. Perform the operations of addition and subtraction.

31

1. $6.4 \text{ cm} + 2.3 \text{ cm} = \underline{8.7} \text{ cm}$

2. $13.5 \text{ mm} - 2.5 \text{ mm} = \underline{11.0} \text{ mm}$

3. $7.6 \text{ m} + 2 \text{ m} = \underline{9.6} \text{ m}$

4. $8 \text{ dm} - 4 \text{ dm} = \underline{4} \text{ dm}$

5. $3.8 \text{ cm} + 5.64 \text{ cm} + 2.1 \text{ cm} = \underline{11.54} \text{ cm}$

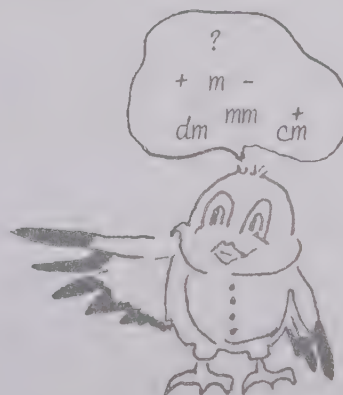
6. $5.2 \text{ cm} - 3.64 \text{ cm} + 2.1 \text{ cm} = \underline{3.66} \text{ cm}$

7. $55 \text{ mm} + 8 \text{ cm} = \underline{13.5} \text{ cm}$

8. $9.3 \text{ cm} + .2 \text{ cm} = \underline{9.5} \text{ cm}$

9. $100 \text{ mm} + .2 \text{ cm} = \underline{10.2} \text{ cm}$

10. $5.3 \text{ cm} + 2.6 \text{ mm} + 12 \text{ mm} = \underline{6.76} \text{ cm}$



DEVELOPMENT AND EXERCISES

STRAND: Measurement

LEVEL: 7

UNIT: V

OBJECTIVE NO. 9

OBJECTIVE: Solve problems involving measurement.

SUGGESTED DEVELOPMENT: (i) Review your problem procedure.

(ii) Do sample problems.

(iii) Assign selected problems.

Each basketball uniform needs 1.5 metres of material. How many metres of material are needed for 11 uniforms? (16.5 m)

If infrared radiation in sunlight has a wave length of 0.0925 cm, what is the wavelength in metres? (0.000 925 m)



How many metres does it take to enclose a four sided pen whose sides are 1.2 m, 0.0013 km, 140 cm, and 1400 mm? (5.3 m)

Alfie saw exactly the same wire in two different stores. Store A sold 15 metres of wire for \$33.90. Store B sold 1400 cm for \$28.42. Which store sells the cheaper wire? (Store B. $A = \$2.26/m$, $B = \$2.03/m$)

The Super ALGX goes 200 km per hour. If the distance is 320 km from Edmonton to Calgary, how long would it take to make this trip? (1.6 h)
(1 h 36 min)



Don is building a book case two metres high. He is using two rows of bricks and therefore needs four metres of bricks. If each brick is four centimetres high, how many bricks does he need? (100)

A gardener is planting five straight rows of peas. Each row is 1 000 centimetres long. If he plants three seeds per centimetre, how many seeds are needed for all five rows? (15000)

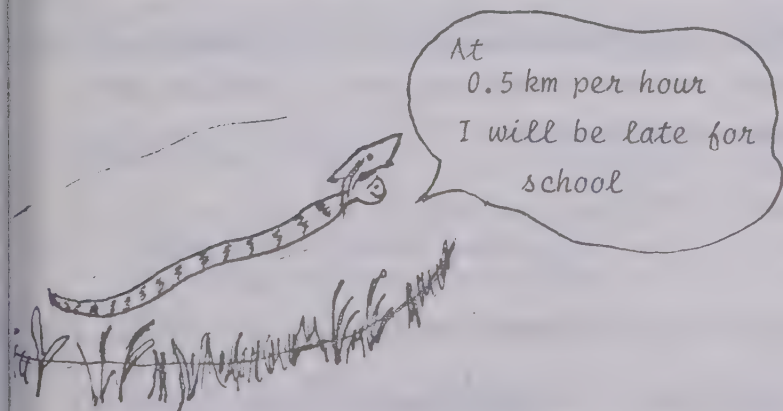
If each sheet of page in a book is 0.001 cm thick, how many pages are needed to make a book 0.2 cm thick? (200)

Maurice's hair is 2 centimetres long. His hair grows 1 centimetre every two months. How long will it take until his hair is 0.1 metres long? (16 mos)

If a snake slithers through a slough at the rate of 0.5 km per hour, how far will he go in 2.5 hours? How long would it take him to go 1 000 cm? (1.25 km)
(0.02 h)

If the price of measuring device is determined by the length of the device, how much does a metre stick cost when a 30 cm metric ruler costs 30 cents? (\$1.00)

At
0.5 km per hour
I will be late for
school



DEVELOPMENT AND EXERCISES

STRAND: Measurement

LEVEL: 7

UNIT: V

OBJECTIVE NO. 10

OBJECTIVE: Write the standard units of mass and capacity in SI and use SI prefixes to generate larger and smaller units.

SUGGESTED DEVELOPMENT: I. MASS

- (i) Prepare a transparency showing a comparison of the British pound and the kilogram.
- (ii) Discuss with the class the use of SI prefixes to generate larger and smaller units of mass.
(NB - include tonne - $1000 \text{ kg} = 1 \text{ Mg}$).
- NOTE: *mg as compared with Mg*
- (iii) Have the students complete the chart in Exercise #I.
- (iv) Do problems involving mass using SI units.

II. CAPACITY

- (i) Prepare a transparency showing a comparison of the British quart and the litre.
- (ii) Discuss with the class the use of SI prefixes to generate larger and smaller units of capacity.
- (iii) Discuss with the class the relationship that exists between linear measures of volume and measures of capacity.
$$\text{i.e. } 1 \text{ dm}^3 = 1 \ell$$
$$1 \text{ cm}^3 = 1 \text{ mL}$$
- (iv) Have students complete the chart in Exercise #II.
- (v) Do problems involving capacity using SI units.

I.

1 mg	1 g	1 kg	1 Mg or 1 t
10^{-6} kg	10^{-3} kg		10^3 kg
10^{-5} hg	10^{-2} hg	10 hg	10^4 hg
10^{-4} dag	10^{-1} dag	10^2 dag	10^5 dag
10^{-3} g		10^3 g	10^6 g
10^{-2} dg	10 dg	10^4 dg	10^7 dg
10^{-1} cg	10^2 cg	10^5 cg	10^8 cg
	10^3 mg	10^6 mg	10^9 mg

1 ml	1 cl	1 dl	1 l	1 dal	1 hl	1 kl
10^{-6} kl	10^{-5} kl	10^{-4} kl	10^{-3} kl	10^{-2} kl	10^{-1} kl	
10^{-5} hl	10^{-4} hl	10^{-3} hl	10^{-2} hl	10^{-1} hl		10 hl
10^{-4} dal	10^{-3} dal	10^{-2} dal	10^{-1} dal		10 dal	10^2 dal
10^{-3} l	10^{-2} l	10^{-1} l		10 l	10^2 l	10^3 l
10^{-2} dl	10^{-1} dl		10 dl	10^2 dl	10^3 dl	10^4 dl
10^{-1} cl		10 cl	10^2 cl	10^3 cl	10^4 cl	10^5 cl
	10 ml	10^2 ml	10^3 ml	10^4 ml	10^5 ml	10^6 ml

WHAT SIZE IN SI?

A. If you are to buy the following items after Canada adopts the SI units, what size would you buy? (All answers are approximate)

- 3 qts. of milk. (3 l)
- 5 lbs. of potatoes. (2 kg)
- 100 ft. of wax paper. (30 m)
- 6 10 oz. cokes. (200 ml)
- 3 lbs. of hamburger. (1.5 kg)
- 1 pt. of ice cream. (500 ml)

B. Some products have already converted to SI units. Find out the SI sizes of the following.

- Toothpaste (3 sizes). (50 ml, 100 ml, 150 ml)
- Dry breakfast cereal (3 sizes).
- Large jar of instant coffee. (Approx. 300 g)
- Large bottle of shampoo.
- Small can of hair spray. (Approx. 150 ml) (Approx. 750 ml)

(Answers will vary: 400 g, 500 g, 600 g)

- 132 -

LABS

LEVEL 7

UNIT VI

EXPONENTS

OBJECTIVE: *Write the values for powers.*

SUGGESTED DEVELOPMENT FOR THE LAB APPROACH:

TIME: 40 minutes maximum

ORGANIZATION: Groups of 2 students

MATERIALS: Each group should have:

1. Sheet of paper about 30 cm square
2. Instructions as attached
3. Pencil, for recording observations

PREREQUISITES:

1. The terms "factors", "base", and "exponent" should have been introduced to the class prior to the use of this lab.
2. The teacher should outline to the class the procedure to be used for proper disposal of the scraps of paper that this lab will engender.

STUDENT ACTIVITIES:

INSTRUCTIONS

OBSERVATIONS:

1. Tear the sheet of paper in half
2. Place the two pieces together and tear these in half again.
3. Place the pieces together and tear again.
4. Place pieces together and tear once again.
5. Without tearing any more paper consider what would happen if you were to tear all the pieces of paper one more time.

How many pieces do you have? _____

How many pieces do you have now? _____

How many pieces do you have now? _____

How many pieces do you have now? _____

How many pieces would you have now? _____

6. Summarize your results:

	1. Number of pieces produced	2. Number of pieces expressed using only 2's as factors	3. Number of times 2's are used as factors	4. Number of pieces expressed using base of 2 and exponent
First tearing	2	2	1	2^1
Second time	4	2×2	2	2^2
Third time	8	$(2 \times 2) \times 2$	3	2^3
Fourth time	_____	$(2 \times 2 \times 2) \times 2$	_____	_____
Fifth time	_____	_____	_____	_____

7. What do you notice when you compare column 3 and column 4?

8. Compare columns 4, 2 and 1 and then find the values for the following:

a. $2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 =$ _____.

b. $3^2 =$ _____ \times _____ $=$ _____.

c. $3^3 =$ _____ \times _____ \times _____ $=$ _____.

d. $4^3 =$ _____ \times _____ \times _____ $=$ _____.

e. $5^2 =$ _____ \times _____ $=$ _____.

ACTIVITIES

LEVEL 7

UNIT VI

EXPONENTS

Power Dice Game

NUMBER OF PLAYERS: Two

MATERIALS REQUIRED: Pair of dice (different colours for basic game), pen or pencil, score sheet. The preparation of a score sheet may help speed up the game. The score sheet would look like the following:

NAME: <u>Player A</u>				NAME: <u>Player B</u>			
Value of Base Die	Value of Exponent Die	Power and Value	Cumulative Total	Value of Base Die	Value of Exponent Die	Power and Value	Cumulative Total
6	3	$6^3 = 216$	216	6	3	$6^3 = 216$	-
'	'	'	'	'	'	'	'
'	'	'	'	'	'	'	'
'	'	'	'	'	'	'	'
'	'	'	'	'	'	'	'

RULES OF THE BASIC GAME:

One die is designated as the base die, the other as the exponent die.
(To avoid confusion, a black die may be used as the base die).

The game is started by having each player in turn roll the dice. The player who rolls the highest total starts.

The first player (player A in the example) rolls the dice. Both players record on the score sheet the outcome. For example: a roll of 6 on the base die and 3 on the exponent die would be recorded as shown on the score sheet above. Both players compute the value of the power.

RULES OF THE BASIC GAME: (cont'd)

4. If the player who rolls the dice correctly computes the power value, this value is added into his cumulative total column. If the player computes the value of the power incorrectly, and his opponent computes it correctly, then the opponent can claim the total. No points are awarded if both players compute the value incorrectly.
5. If a player rolls a double (same value on each die), he gets another turn.
6. The player with the highest total score after ten minutes is declared the winner.

POSSIBLE VARIATIONS:

The game outlined above is called the 'basic game' and is suggested for students who have had limited experience with exponents. Some possible variations of the game might include:

1. Make new die for base and/or exponent. For example, the base die could be altered to have faces with values of 1, 3, 5, 7, 11, while the exponent die remains the same. (To avoid causing too much drudgery, the teacher should choose the values carefully).
2. Rather than a time limit, the game could end when one player reaches an agreed upon total score, say 75,000. (Keep in mind that $6^6 = 46,656$).

APPLICATIONS

LEVEL 7

UNIT VI

EXPONENTS

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- Schor, Meng, Insights and Skills Parts 1, 2 and 3, Globe Book Co., New York 1973
- Stein, Practical Applications in Mathematics, Allyn and Bacon Inc., Boston, 1972
- Witherding, Margaret F., From Fingers to Computers, Franklin Publications Inc Chicago, 1970

VIDEO TAPES

ETV Math Series produced in Ontario Tape #1 Part D

Approximating & Estimations

Good for Grade 8 Measurement Applications

Tape #3 Part B

So You Want to Buy a Car

(Application in credit buying Grade 9 level)

Tape #5 Part A

Art from Computers

Useful as maxirational unit for applying Math to Art any grade level.

LEVEL 7

EXPONENTS

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OBJECTIVES

UNIT VI

Sectio

*EXPONENTS

Students should be able to:

- *1. Use the terms base, power, exponent, square, and cube.
- *2. Write the values for powers. (Limit: bases - whole exponents - whole). Standard name of a power numeral.
- *3. Use exponential notation to write the expanded form of whole and decimal numerals.

EXPONENTS

UNIT VI

A.

1. In order to describe distances between stars, scientists use a unit called a light year, which is the distance light will travel through space in one year.

- (a) Use a calculator to calculate this distance in kilometres. Keep five significant digits in each step of your calculations.

Light travels 2.9977×10^5 km/s;

Thus it travels $2.9977 \times 10^5 \times 6 \times 10^4 =$ a km/min;

or $a \times 6 \times 10^4 =$ b km/h;

or $b \times 24 =$ c km/day;

or $c \times 3.6525 \times 10^2 =$ d km/year.

a =

b =

c =

d =

Thus a light year is km.

- (b) The nearest star is 4.3 light years away. To find the distance of this star in kilometres, you could multiply 4.3 x the length of a light year in kilometres.

The nearest star is km from the earth.

- (c) Find the distance in kilometres of each of the following stars (to five significant digits).

(i) Sirius - 9 light years = km.

(ii) Aldebaran - 55 light years = km.

(iii) Andromeda Galaxy - 7.5×10^5 light years = km.

2. How old will you be on your 16th birthday? You never know when someone may ask you how old you are in seconds, so try these. Use a calculator and maintain five significant digits, or three digits if you don't have a calculator.

Number of seconds in 1 hour = $6 \times 10^1 \times 6 \times 10^1 =$ a

Number of seconds in 1 day = $a \times 2.4 \times 10^1 =$ b

Number of seconds in 1 year = $b \times 3.6525 \times 10^2 =$ c

Number of seconds in 16 years = $c \times 1.6 \times 10^1 =$ d

a =

b =

c =

d =

Therefore on your 16th birthday you will be seconds old.

3. A gigasecond = 10^9 s. If your teacher says he/she is one gigasecond old, how old is he/she? Here are some hints.

$$10^9 + 6 \times 10^1 = \text{ w }$$

$$w + 6 \times 10^1 = \text{ x }$$

$$x + 2.4 \times 10^1 = \text{ y }$$

$$y + 3.6525 = \text{ z }$$

4. The book Azimuth, published by Monroe, "The Calculator Company", has many interesting activities you can try with calculators.

B.

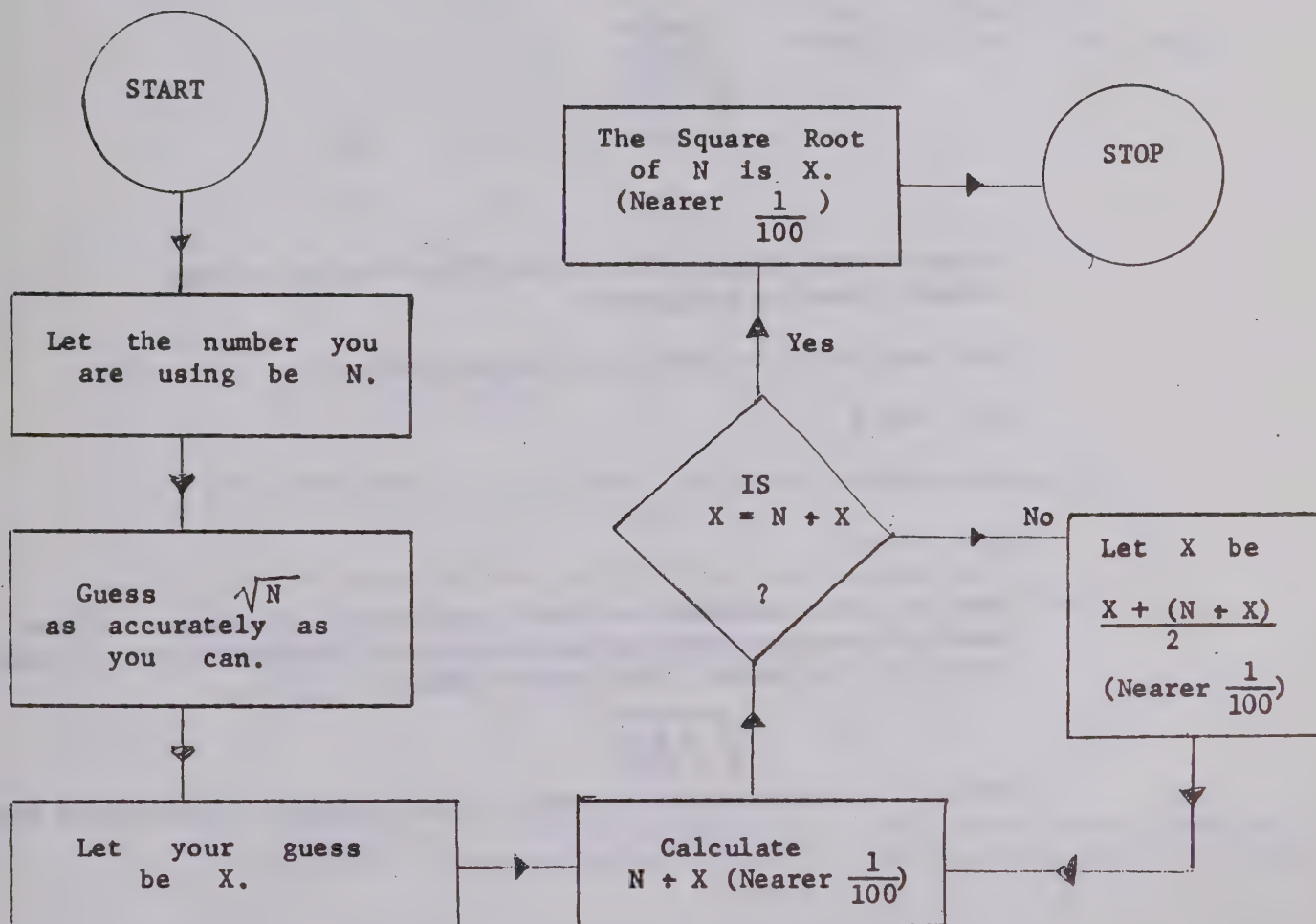
- Use Newtons method (shown in the following flow chart) and a calculator to find the square root of the following numbers to the nearer one-hundredth.

(a) $\sqrt{7}$ =

(b) $\sqrt{85}$ =

(c) $\sqrt{150}$ =

(d) $\sqrt{2098}$ =



2. Square roots have many applications in the world around us. Try some of the following.

- (a) The time taken for a falling object to hit the ground varies directly as the square root of the height of the object. The formula used is

$$T = \sqrt{\frac{h}{4.8}}$$

where T is the time falling in seconds and h is the height of the object in metres.

E.g. How long would it take you to reach the ground if you jumped off the Calgary Tower. The Calgary Tower is about 192 m high.

$$T = \sqrt{\frac{192}{4.8}}$$

$$T = 40$$

$$T = 6.3$$

It would take about 6.3 s to fall from the top of the Calgary Tower to the ground.

How long would it take for an object to fall:

- (i) 480 m
- (ii) 19.2 m
- (iii) 48 km

- (b) Have you ever wondered how fast ocean waves hit the beach? The speed of an ocean wave varies directly as the square root of the length of the waves. The formula used is

$$V = \sqrt{\frac{4.8 w}{\pi}}$$

where V is the velocity (speed) of the wave and w is the wave length

E.g. How fast would a surfer move towards the shore if the wave length was 25 m?

$$V = \sqrt{\frac{4.8 w}{3.14}}$$

$$V = \sqrt{\frac{4.8}{3.14}} \cdot \sqrt{w}$$

$$V = \sqrt{\frac{4.8}{3.14}} \cdot \sqrt{w}$$

$$V = 1.24 \times \sqrt{w}$$

You can start your calculations at this point.

$$V = 1.24 \times \sqrt{25}$$

$$V = 1.25 \times 5$$

$$V = 6.2$$

The waves move 6.2 m/s, thus the surfer would be moving at 6.2 m/s if he kept even with the waves.

Find the speed of the waves if the wave length was:

(i) 100 m

(ii) 400 m

3. For more ideas about using square roots, watch the videotape program, "Square Root - Newton's Method", Tape 3, from the Ontario E.T.V. Series.

HISTORY

LEVEL 7

UNIT VI

EXPONENTS

REFERENCES

The Committee recommends the following references as primary sources of information for Junior High School teachers and students. We suggest that those books labelled (T) be available as teacher references and those labelled (S) be available in quantities of 3 - 5 for class use. Many of these books may be in your library now and extra copies may be borrowed from the Library Service Centre.

These references are numbered (1 - 14) for referral in the following outline:

1. Adler, Irving. The Giant Golden Book of Mathematics. Golden Press, New York, 1966
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2. Adler, Irving. Readings in Mathematics (book 1). Ginn and Company, Lexington, Massachusetts, 1972.
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3. Adler, Irving. Readings in Mathematics (book 2). Ginn and Company, Lexington, Massachusetts, 1972.
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4. Bell, E.T. Men of Mathematics. Simon and Schuster, New York, 1966.
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5. Bergamini, David. Mathematics (Life Science Library). Time Inc., New York, 1966.
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6. Denholm, Richard A. Mathematics: Man's Key to Progress (Book A) Franklin Publications inc., Chicago, 1970.
(S)
7. Denholm, Richard A. Mathematics: Man's Key to Progress (Book B) Franklin Publications Inc., Chicago, 1970.
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9. Hogben, Lancelot. The Wonderful World of Mathematics. Doubleday and Company, Inc., Garden City, N. Y. 1955.
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(These are additional references for teachers)

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James & James, Mathematics Dictionary, 3rd ed., D. Van Nostrand Company, Inc., Toronto, 1968.

519 King, Amy C. and Read, Cecil B. Pathways to Probability, Holt,
K58 Rinehart and Winston, Inc., New York, 1963.

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Newman, James R. The World of Mathematics. (vol. 1, 2, 3, 4)
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Smith, D. E. History of Mathematics. (Vol. 1, 2) Dover
Publications, Inc., New York, 1958.

920 Turnbull, H. W. The Great Mathematicians. New York University
T849 Press, New York, 1969

Black, Gerald J. Canada Goes Metric. Doubleday Canada Ltd.,
Toronto, 1974.

Posters

1. Walch, J. W. (Publisher) "Posters on Famous Mathematics". Available on loan from the Library Service Centre.
2. I.B.M., Timeline "Men of Mathematics", available from I.B.M. Library, Calgary. Ask for item #5050003 (Free).

Busts

"Mathematicians of the Century" available from Moyer. Available on loan from the Library Service Centre. (Price \$48.00)

Movies

CK "Possibly So Pythagoros". Available on loan from Instructional
10591 Aids Department.

CK "Donald Duck in Math Magic Land". Instructional Aids.
538

Supplementary References

Page 2

Games

1. Euclid. (Western Educational Activities). For advanced students.

The resource list on Posters, Busts, Movies, and games was taken from Men of Mathematics - A Resource Unit developed by J. Barnes.

E. T. V. Math Series (produced in Ontario)
(available from Central Office)

Tape #3 part (a) Square Root: Newton's Method
(Time 20 min., 275 ft.)

Useful for introducing square roots in grades 8 or 9.

Tape #5 part (b) History of Computers
useful as a motivational unit.

Tape #5 part (f) Number Systems
useful for introducing number theory, grade 7.

Tape #6 part (a) History of Numerals
useful in grade 7 whole numbers.

Tape #6 part (b) History of π
grade 9 Geometry

Tape #6 part (c) From Time to Time
development of calendar.

Tape #6 part (f) History of India(n) Mathematics
laid the basis for our present number system and useful in History of Math in an option.

Tape #7 part (a) Inverse Variation
grade 9 functions.

Tape #7 part (b) Graphs
grade 8 coordinate system (Descarte)

Tape #9 part (a) Fibonacci Sequence
grade 8 Real Numbers

Tape #9 part (b) The Divine Proportion: Golden Section
grade 9 Geometry

Tape #9 part (c) Map Making
useful for upper ability students in grade 9 Solid Geometry.

Tape #10 part (c) What are Numbers
history of development of number systems
useful as an introduction to grade 7 number systems.

LEVEL 7

EXPONENTS

OBJECTIVES

UNIT VI

Reference
Activities

Students should be able to:

- *1. Use the terms base, power, exponent, square, and cube.
- *2. Write the values for powers. (Limit: bases - whole exponents - whole). Standard name of a power numeral.
- *3. Use exponential notation to write the expanded form of whole and decimal numerals.

1

ACTIVITIES

1. Read the poem Quantities of Sand by Lewis Carroll in Readings in Mathematics: Book 1, (reference #2), pages 51-54. How much sand could the seven maids clear up if each was able to sweep at the rate of 106 grains of sand per hour, assuming they worked 10 hours per day?

**LEARNING
PACKAGE**

**LEVEL 7
UNIT VI**

EXPONENTS

UNIT VI - EXPONENTS

PERFORMANCE OBJECTIVES

Students should be able to:

- *1. Use the terms base, power, exponent, square and cube.
- *2. Write the values for powers. (Limit: bases - whole, exponents - whole)
- *3. Use exponential notation to write the expanded form of whole and decimal numerals.

DEVELOPMENT AND EXERCISES

STRAND: Exponents

LEVEL: 7

UNIT: VI

OBJECTIVE NO. 1

OBJECTIVE: * Use the terms base, exponents, power, square, and cube.

SUGGESTED DEVELOPMENT: 1. Introduce what you call some "cool numbers" to the students. For example

$$25 = 5 \times 5$$

$$27 = 3 \times 3 \times 3$$

$$32 = 2 \times 2 \times 2 \times 2 \times 2$$

$$1\ 000\ 000 = 10 \times 10 \times 10 \times 10 \times 10 \times 10$$

$$256 = 4 \times 4 \times 4 \times 4$$

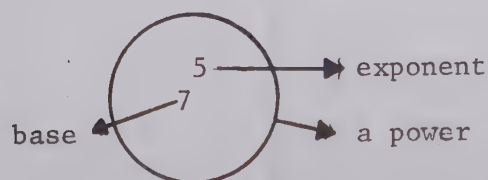
2. Have the students add "cool numbers" to your list. Through the class discussion, the students should be able to determine the characteristics of a "cool number". The two that should be noted are:

- i. only one operation is involved - multiplication.
- ii. for any given number, the same factor appears in the product.

3. Introduce a "cool way" of writing "cool numbers". That is, $25 = 5^2$; $1\ 000\ 000 = 10^6$, etc. Have the students use the "cool way" of writing some of the numbers they came up with earlier.

4. Introduce the formal definition of a power and the associated terms.

e.g.

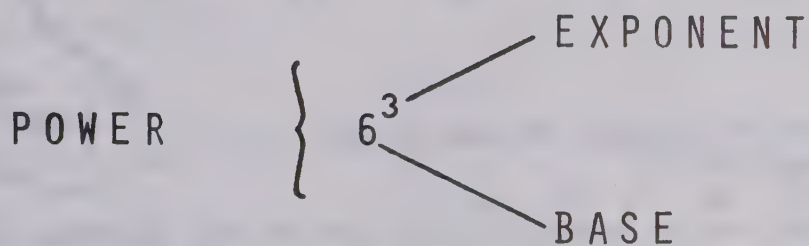


OBJECTIVE NO. 1

5. Indicate the various ways in which this numeral can be read:
- i. The fifth power of seven
 - ii. seven to the fifth power
 - iii. seven to the power five
 - iv. seven exponent five
6. Since exponents 2 and 3 are used extensively, make students aware of the terms "squared" and "cubed".
7. Stress, however, that the numeral has one meaning only, namely, 7^5 means $7 \times 7 \times 7 \times 7 \times 7$, or seven used as a factor five times. The students should be introduced to the term exponential notation (or form) at this point by use of an example. The various ways of writing a number can be illustrated.

e.g.	<u>exponential form</u>	<u>factored form</u>	<u>standard numeral</u>
	7^5	$7 \times 7 \times 7 \times 7 \times 7$	16 807

EXPONENTS



THE EXPONENT INDICATES
THE NUMBER OF TIMES TO USE
THE BASE AS A FACTOR

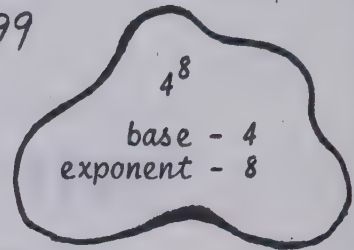
EXPONENTIAL NOTATION	FACTORED FORM	STANDARD NAME
6^3	$6 \times 6 \times 6$	216

EXERCISES:

OBJECTIVE NO. 1

1. For each of the powers given below, name the base.

a. 10^8 b. 3^4 c. 6^7 d. 13^5 e. 99^6
 10 3 6 13 99



2. Name the exponent of each of the powers in #1.

8, 4, 7, 5, 6

3. Write a word description for each of the following powers:

a. 10^8 - ten to the eighth power.

b. 3^4 c. 6^7 d. 13^5 e. 99^6

(b) three to the fourth power

(c) the seventh power of 10
 (d) thirteen to the fifth power
 (e) the sixth power of 99

4. Write each of the following in exponential form:

a. seventeen cubed - 17^3

f. eight exponent two 8^2

b. one hundred squared 100^2

g. eight squared 8^2

c. fifteen exponent four 15^4

h. thirty-six cubed 36^3

d. fifty-two to the power twelve 52^{12}

i. ten to the eleventh power 10^{11}

e. five to the fifth power 5^5

j. seven exponent nine 7^9

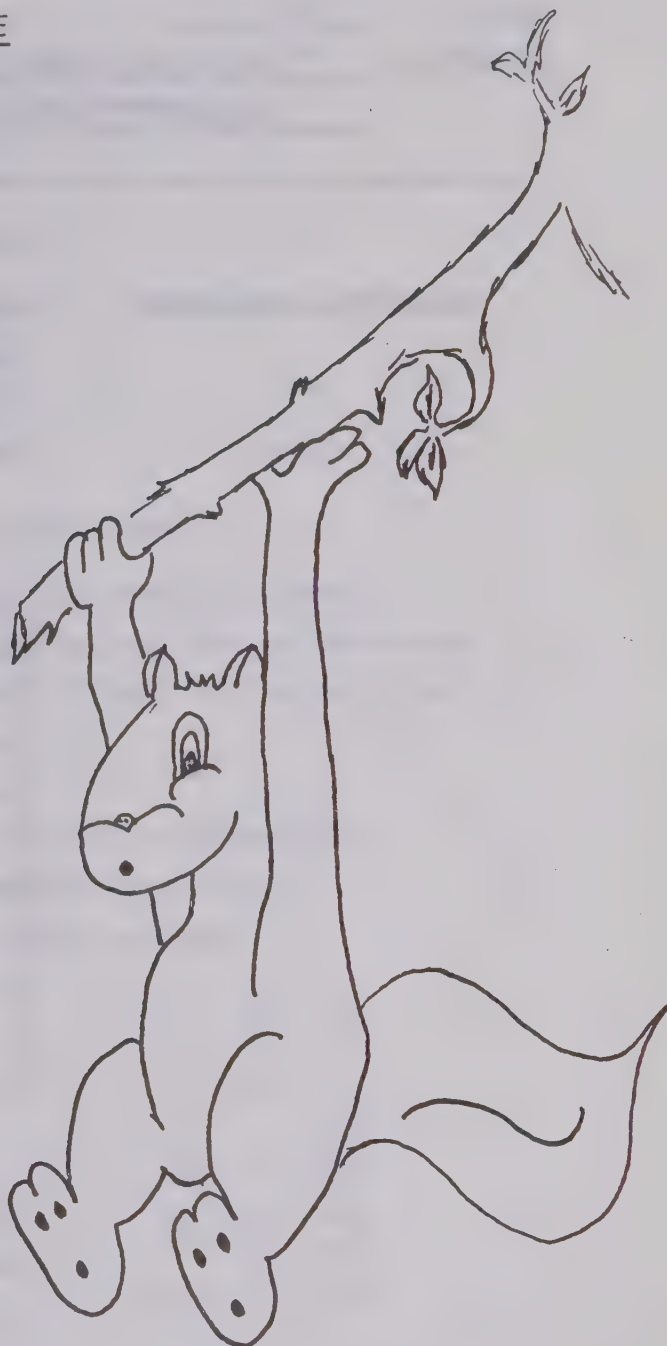
5. Complete the chart.

Exponential form	Base	Exponent	Word Description	Factored form
18^3	18	3	Eighteen to the power of three	$18 \times 18 \times 18$
66^2	66	2	Sixty-six squared	66×66
10^3	10	3	ten cubed	$10 \times 10 \times 10$
17^4	17	4	seventeen to the fourth	$17 \times 17 \times 17 \times 17$
38^5	38	5	the fifth power of thirty-eight	$38 \times 38 \times 38 \times 38 \times 38$
12^2	12	2	Twelve squared	12×12
5^4	5	4	Five to the fourth power	$5 \times 5 \times 5 \times 5$

FLAGGING PAGE

Perform the indicated operations.

1. $724 + 3\,468 = 4\,192$
2. $822 \div 6 = 137$
3. $6\,428 - 389 = 6\,039$
4. $6 + 7 \times 2 - 7 = 13$
5. $(6 \times 8) - (3 \times 4) = 36$
6. $18 \times 3 \times 0 = 0$
7. $468 \div 26 = 18$
8. $124 \times 32 \div 8 = 496$
9. $28 - 3 \times 2 + 4 \times 6 = 46$
10. $2\,476 - 1\,805 + 201 = 872$
11. $6\,000 - 3\,875 = 2\,125$
12. $486 + 21 - 105 = 402$
13. $6\,472 \times 13 = 84\,136$
14. $(9 \times 3 - 3) \div 8 + 7 = 10$
15. $9\,072 \div 72 = 126$
16. $2 \times 2 \times 2 \times 2 \times 2 = 32$
17. $7 \times 7 \times 7 \times 7 = 2\,401$
18. $5 \times 5 \times 5 = 125$
19. $27 - 2 \times 2 \times 2 = 19$
20. $6 \times 6 \times 6 - 5 \times 5 + 3 \times 3 \times 3 = 218$



DEVELOPMENT AND EXERCISES

STRAND: Exponents

LEVEL: 7

UNIT VI

OBJECTIVE NO. 2

OBJECTIVE: * Write the values for powers. (limit: bases - whole numbers; -exponents- whole numbers.)

SUGGESTED DEVELOPMENT:

Prepare a chart like the following on a transparency and by question and answer method show how a numeral in exponential form can be written as a standard numeral.

Exponential form	Factored form	Standard form
2^5	$2 \times 2 \times 2 \times 2 \times 2$	32
11^4		
7^3		
25^2		

Students should have little difficulty with the objective, provided they understand the meaning of a power and can multiply accurately.

1. Show the factored form and find the standard numeral.

a. $15^2 = 15 \times 15 = 225$

b. $9^3 = 729$ e. $33^3 = 35937$ h. $5^6 = 15625$

c. $2^7 = 128$ f. $1^8 = 1$ i. $258^2 = 66564$

d. $6^5 = 7776$ g. $12^4 = 20736$ j. $19^4 = 130321$

2. What's the difference between a teacher and a train?

To find the answer to this question, find the standard numeral for each power in questions 1 to 15. Then use the key at the bottom to get a letter from the standard numeral. Place this letter in any blank that has its question number below it.

e.g. #8. $11^2 = \underline{\quad}$ Since $11^2 = 121$, and 121 is paired with n in the key, we put an n whenever we see an 8 (question number) below the blank, as shown.

1. $2^5 = \underline{a}$

6. $10^2 = \underline{i}$

11. $5^3 = \underline{t}$

2. $3^2 = \underline{c}$

7. $3^4 = \underline{m}$

12. $6^3 = \underline{u}$

3. $10^4 = \underline{e}$

8. $11^2 = \underline{121}$

13. $3^5 = \underline{w}$

4. $8^2 = \underline{g}$

9. $7^2 = \underline{r}$

14. $6^2 = \underline{y}$

5. $5^2 = \underline{h}$

10. $3^3 = \underline{s}$

15. $2^3 = \underline{o}$

243	8	49	9	10 000	36	32	81	121	64
w	o	r	c	e	y	a	m	n	g

216	25	27	100	125
u	h	s	i	t

a teacher says throw out
 your gum a train says choco
 choo.

EXPONENTS

IN THE POWER x^a

- "x" CAN BE REPLACED BY ANY
WHOLE NUMBER

- "a" CAN BE REPLACED BY ANY
WHOLE NUMBER

EXPONENTIAL NOTATION	FACTORED FORM	STANDARD NAME
5^3	$5 \times 5 \times 5$	125
3^5	$3 \times 3 \times 3 \times 3 \times 3$	243
2^4	$2 \times 2 \times 2 \times 2$	16
10^2	10×10	100
10^3	$10 \times 10 \times 10$	1000

EXERCISES:

OBJECTIVE NO. 2

3. Match the standard numeral in Column II with the exponential form in Column I by placing the appropriate letter under Column II in the blank supplied with Column I.

Column I

e 8^3

c 3^5

g 10^{10}

a 20^4

h 4^6

d 101^2

b 2^8

Column II

a. 160 000

b. 256

c. 243

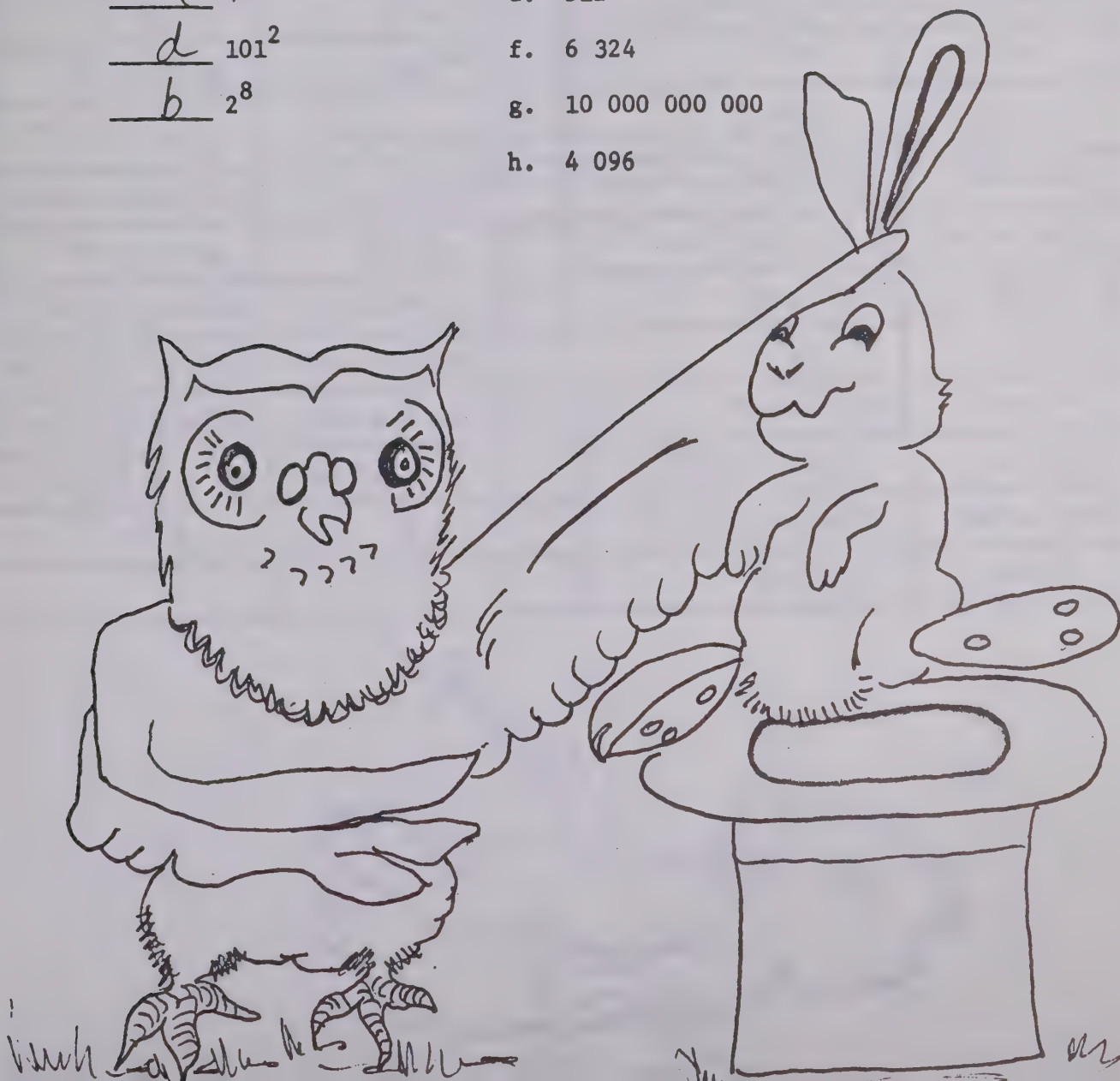
d. 10 201

e. 512

f. 6 324

g. 10 000 000 000

h. 4 096



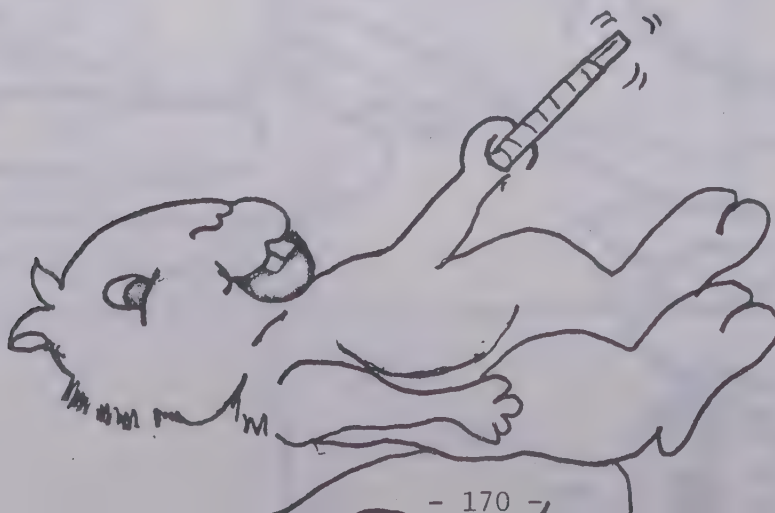
EXERCISES:

OBJECTIVE NO. 2

4. It is possible to express the integers from 1 to 25 as the sum of not more than four square numbers. A chart has been prepared below and the first few sums are done for you. Complete the chart. For some numbers, more than one combination is possible.

A square number is a number that is a perfect square
e.g. 1, 4, 9, 16, 25, etc.

No.	Sum of Square Numbers	Sum of Square Numbers in Exponent Form	No.	Sum of Square Numbers	Sum of Square Number in Exponent Form
1	1	1^2	14	$9+4+1$	$3^2+2^2+1^2$
2	$1+1$	1^2+1^2	15	$9+4+1+1$	$3^2+2^2+1^2+1^2$
3	$1+1+1$	$1^2+1^2+1^2$	16	16	4^2
4	4	2^2	17	$16+1$	4^2+1^2
5	$4+1$	2^2+1^2	18	$16+1+1$	$4^2+1^2+1^2$
6	$4+1+1$	$2^2+1^2+1^2$	19	$16+1+1+1$	$4^2+1^2+1^2+1^2$
7	$4+1+1+1$	$2^2+1^2+1^2+1^2$	20	$16+4$	4^2+2^2
8	$4+4$	2^2+2^2	21	$16+4+1$	$4^2+2^2+1^2$
9	9	3^2	22	$16+4+1+1$	$4^2+2^2+1^2+1^2$
10	$9+1$	3^2+1^2	23	$9+9+4+1$	$3^2+3^2+2^2+1^2$
11	$9+1+1$	$3^2+1^2+1^2$	24	$16+4+4$	$4^2+2^2+2^2$
12	$9+1+1+1$	$3^2+1^2+1^2+1^2$	25	25	5^2
13	$9+4$	3^2+2^2			



DEVELOPMENT AND EXERCISES

STRAND:	<u>Exponents</u>	LEVEL:	<u>7</u>
UNIT:	<u>VI</u>	OBJECTIVE NUMBER:	<u>3</u>
OBJECTIVE:	<u>*Use exponential form to write the expanded form of whole and decimal numerals.</u>		

- SUGGESTED DEVELOPMENT:
1. Prepare the expanded form transparencies.
Discuss with students the logical development of the chart with the numeral 5 736.
 2. Note that the idea of exponent 1 and exponent 0 falls into the descending order of exponents. Before proceeding on to the second part of the development, you might have the students do several similar charts using five and six digit numerals.
 3. The expanded form of decimal numerals can also be developed using a chart.
The numeral is 4 738.762 5.

EXPANDED FORM

STANDARD NUMERAL	5	7	3	6
PLACE VALUE	1 000	100	10	1
VALUE OF EACH DIGIT	$5 \times 1\,000$	7×100	3×10	6×1
FACTORED FORM SHOWING BASE TEN	$5 \times 10 \times 10 \times 10$	$7 \times 10 \times 10$	3×10	6×1
EXPONENTIAL FORM	5×10^3	7×10^2	3×10^1	6×10^0
NUMERAL IN EXPANDED FORM	$(5 \times 10^3) + (7 \times 10^2) + (3 \times 10^1) + (6 \times 10^0)$			

DECIMAL NUMERAL	4	7	3	8	7	6	2	5
PLACE VALUE	1 000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1\ 000}$	$\frac{1}{10\ 000}$
VALUE OF EACH DIGIT	$4 \times 1\ 000$	7×100	3×10	8×1	$7 \times \frac{1}{10}$	$6 \times \frac{1}{100}$	$2 \times \frac{1}{1\ 000}$	$5 \times \frac{1}{10\ 000}$
FACTORED FORM SHOWING BASE TEN	$4 \times 10 \times 10 \times 10$	$7 \times 10 \times 10$	3×10	8×1	$7 \times \frac{1}{10}$	$6 \times \frac{1}{10 \times 10}$	$2 \times \frac{1}{10 \times 10 \times 10}$	$5 \times \frac{1}{10 \times 10 \times 10 \times 10}$
EXPONENTIAL FORM	4×10^3	7×10^2	3×10^1	8×10^0	7×10^{-1}	6×10^{-2}	2×10^{-3}	5×10^{-4}
NUMERAL IN EXPANDED FORM	$(4 \times 10^3) + (7 \times 10^2) + (3 \times 10^1) + (8 \times 10^0) + (7 \times \frac{1}{10^{-1}}) + (6 \times \frac{1}{10^{-2}}) + (2 \times \frac{1}{10^{-3}}) + (5 \times \frac{1}{10^{-4}})$							

EXERCISES:

OBJECTIVE NO. 3

1. Complete the following chart for numeral 862.345

Decimal Numeral	8	6	2	3	4	5
Place Value	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
Value of each digit	8×100	6×10	2×1	$3 \times \frac{1}{10}$	$4 \times \frac{1}{100}$	$5 \times \frac{1}{1000}$
Factored form showing base ten	$8 \times 10 \times 10$	6×10	2×1	$3 \times \frac{1}{10}$	$4 \times \frac{1}{10 \times 10}$	$5 \times \frac{1}{10 \times 10 \times 10}$
Exponential Form	8×10^2	6×10^1	2×10^0	$3 \times \frac{1}{10^1}$	$4 \times \frac{1}{10^2}$	$5 \times \frac{1}{10^3}$
Expanded Form	$(8 \times 10^2) + (6 \times 10^1) + (2 \times 10^0) + (3 \times \frac{1}{10^1}) + (4 \times \frac{1}{10^2}) + (5 \times \frac{1}{10^3})$					

2. Write the expanded form using exponential form for each of the following:

- a. 3 476.329 *SEE ABOVE* d. 1.360 8
 b. 5 031.067 *FORMAT* e. 0.409 62
 c. 90 084.803 2 f. 0.000 1

Reminder:

$10^0 = 1 ;$

$10^1 = 10$

3. Write decimal numerals for the following numerals.

- a. $(4 \times 10^2) + (3 \times 10^1) + (7 \times 10^0) + (8 \times \frac{1}{10^1}) + (6 \times \frac{1}{10^2}) + (3 \times \frac{1}{10^3})$
 437.863
- b. $(6 \times 10^3) + (0 \times 10^2) + (8 \times 10^1) + (2 \times 10^0) + (0 \times \frac{1}{10^1}) + (4 \times \frac{1}{10^2})$
 6082.04
- c. $(1 \times 10^4) + (3 \times 10^3) + (9 \times 10^2) + (0 \times 10^1) + (4 \times 10^0) + (5 \times \frac{1}{10^1}) + (0 \times \frac{1}{10^2}) + (8 \times \frac{1}{10^2})$ 13 904.508
- d. $(4 \times \frac{1}{10^1}) + (8 \times \frac{1}{10^2}) + (0 \times \frac{1}{10^3}) + (7 \times \frac{1}{10^4})$ 0.4807
- e. $(9 \times 10^4) + (0 \times 10^3) + (0 \times 10^2) + (4 \times 10^1) + (8 \times 10^0) + (0 \times \frac{1}{10^1}) + (8 \times \frac{1}{10^2})$
 90 048.08
- f. $(0 \times \frac{1}{10^1}) + (0 \times \frac{1}{10^2}) + (4 \times \frac{1}{10^3}) + (8 \times \frac{1}{10^4}) + (5 \times \frac{1}{10^5})$
 0.004 85

REVIEW EXERCISES:

OBJECTIVES NO. 1 - 3

1. For each power listed below, name the base and the exponent:

- a. 126^3 base 126 exponent 3 b. 15^0 base 15 exponent 0 c. 6^6 base 6 exponent 6

2. Indicate the factored form.

- a. $5^7 = \underline{5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5}$ d. $10^0 = \underline{1}$
 b. $100^3 = \underline{100 \times 100 \times 100}$ e. $3^4 = \underline{3 \times 3 \times 3 \times 3}$
 c. $12^4 = \underline{12 \times 12 \times 12 \times 12}$ f. $6^2 = \underline{6 \times 6}$

3. Write exponential form for:

- a. seven cubed 7^3 c. one thousand squared 1000^2
 b. the twelfth power of ten 10^{12} d. ninety exponent seven 90^7

4. Write a word description for each of the following powers:

- a. 8^5 eight to the fifth c. 21^3 twenty-one cubed
 b. 10^0 ten to the zero power d. 46^2 forty-six squared

5. Write the standard numeral for each of the following:

- a. 143^2 20449 d. 10^4 10000
 b. 5^3 125 e. 10^0 1
 c. 1^{10} 1 f. 10^1 10

6. Write the expanded form for the following decimal numerals:

- a. 612.35 b. 212 c. 1 020.406
 $(6 \times 10^2) + (1 \times 10^1) + (2 \times 10^0) + (3 \times \frac{1}{10^1}) + (5 \times \frac{1}{10^2})$

7. Write decimal numerals for:

- a. $(6 \times 10^3) + (5 \times 10^2) + (0 \times 10^1) + (3 \times 10^0) + (0 \times \frac{1}{10^1}) + (9 \times \frac{1}{10^2})$
6503.09
 b. $(9 \times 10^1) + (6 \times 10^0) + (7 \times \frac{1}{10^1}) + (2 \times \frac{1}{10^2}) + (4 \times \frac{1}{10^3}) + (8 \times \frac{1}{10^4})$
96.7248

8.

MATCH 'EM UP!

Below are two blocks of sixteen rectangles. The upper block of rectangles contains exponential form while the lower block contains standard numerals. You are to calculate the standard numeral for each power in the top block, and find the answer in the bottom block. When you have done this, transfer the word from the corresponding top rectangle to the appropriate bottom rectangle. That is where we get the title "Match 'Em Up".

If you do this correctly, the words in the bottom block should form a corny saying that is bound to be an earful!

EXAMPLE: Since $6^4 = 6 \times 6 \times 6 \times 6 = 1\,296$, the word "what" is placed in the rectangle having the number 1 296.

4^3 64 ONLY	8^3 512 TO	2^5 32 US	10^4 10 000 DROP
3^4 81 BETWEEN	6^4 1296 WHAT	30^3 27 000 SAY	15^3 3375 EAR
7^4 2401 OVER	4^5 1024 ONE	9^3 729 THE	6^5 7776 BLOCK
10^0 1 DID	18^2 324 A	5^1 5 OTHER	6^2 36 THERE'S

1 296 WHAT	1 DID	1 024 ONE	3 375 EAR
27 000 SAY	512 TO	729 THE	5 OTHER ?
10 000 DROP	2 401 OVER	36 THERE'S	64 ONLY
324 A	7 776 BLOCK	81 BETWEEN	32 US

LABS

LEVEL 7

UNIT 7

GEOMETRY

OBJECTIVE: *To classify polygons.*

SUGGESTED DEVELOPMENT FOR THE LAB APPROACH:

TIME: The lab can be done in one class period.

MATERIALS: 1 pair of scissors, 1 pencil, 1 metric ruler, 1 protractor, Lab sheets, Part I, Lab sheets, Part II.

ORGANIZATION: Each student will receive two lab sheets, part I and part II. Only after part I is completed should part II be given to the student.

METHOD: 1. Students should cut out the polygons from part I and arrange in their own order, using as many categories as they wish. Their data should then be recorded in a chart as below.

Polygons grouped together	Reasons grouped together

2. Discuss the various methods of grouping used by the students.
3. Students will require the cutouts from lab 1 for lab 2.
4. Discussion may follow lab 2.

TEACHER NOTE: Students should know the definition of a polygon.

"A polygon is a closed curve made up of line segments".

CLASSIFICATION OF POLYGONS

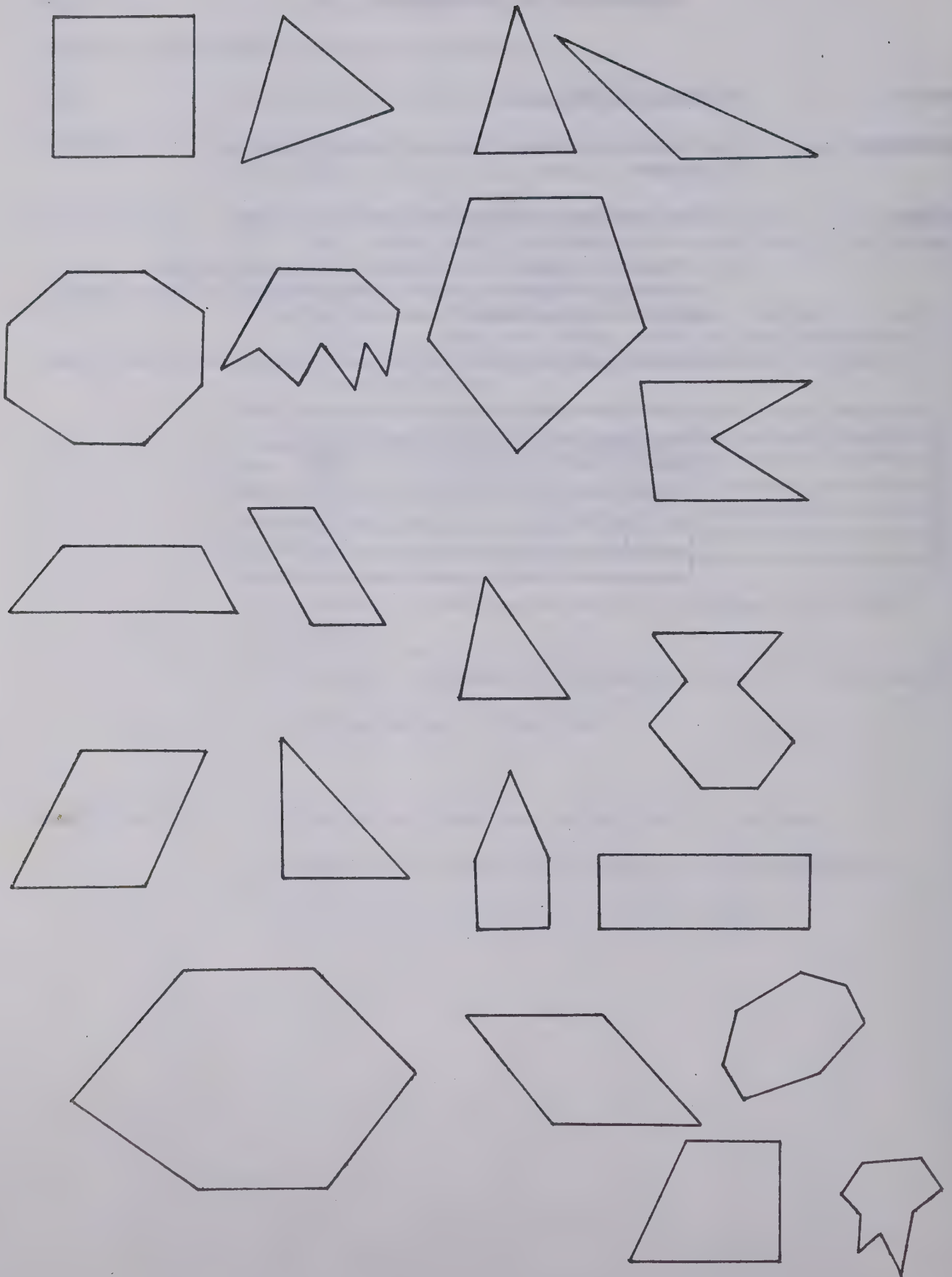
PURPOSE: To classify polygons

MATERIALS: 1 pair of scissors, 1 pencil, 1 metric ruler, 1 protractor

- METHOD:
1. Cut out the polygons on part 1 lab page.
 2. Group the figures according to your own method. Use as many categories as you feel necessary. State which polygons you grouped together. Why?
 3. Record your data in the form of a chart as shown below.

Polygons	Reason grouped together

PART I



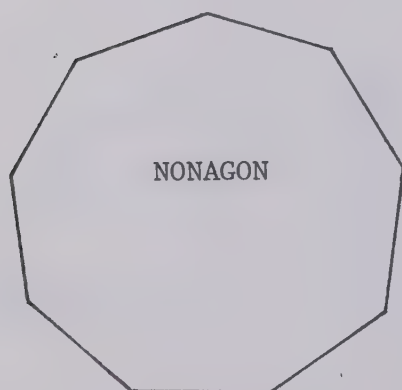
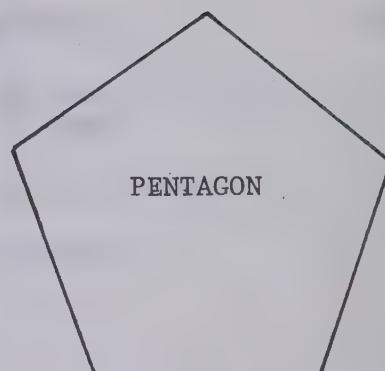
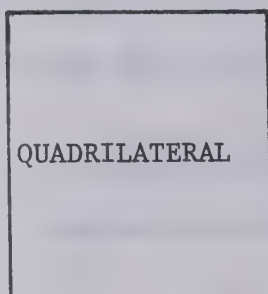
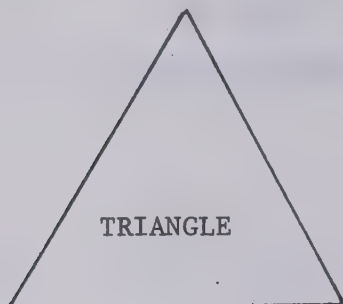
PART II

METHOD:

1. Complete the chart on part II (a) of the lab.
2. Use the cut-outs from part I to complete chart on part II (b).
3. Fill in the conclusion.
4. Complete the application.

Part II (a)

Given the following polygons complete the chart below:



POLYGON	NUMBER OF SIDES
Triangle	
Quadrilateral	
Pentagon	
Hexagon	
Heptagon	
Octagon	
Nonagon	
Decagon	
Dodecagon	

Part II (b)

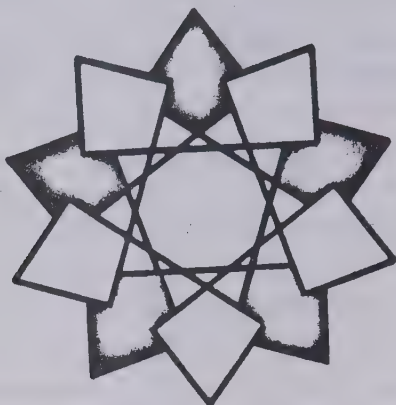
From the previous chart classify the figures you cut out.

POLYGON	NUMBER OF SIDES	POLYGON CLASSIFICATION
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		
K		
L		
M		
N		
O		
P		
Q		
R		
S		
T		
U		
Conclusion:		

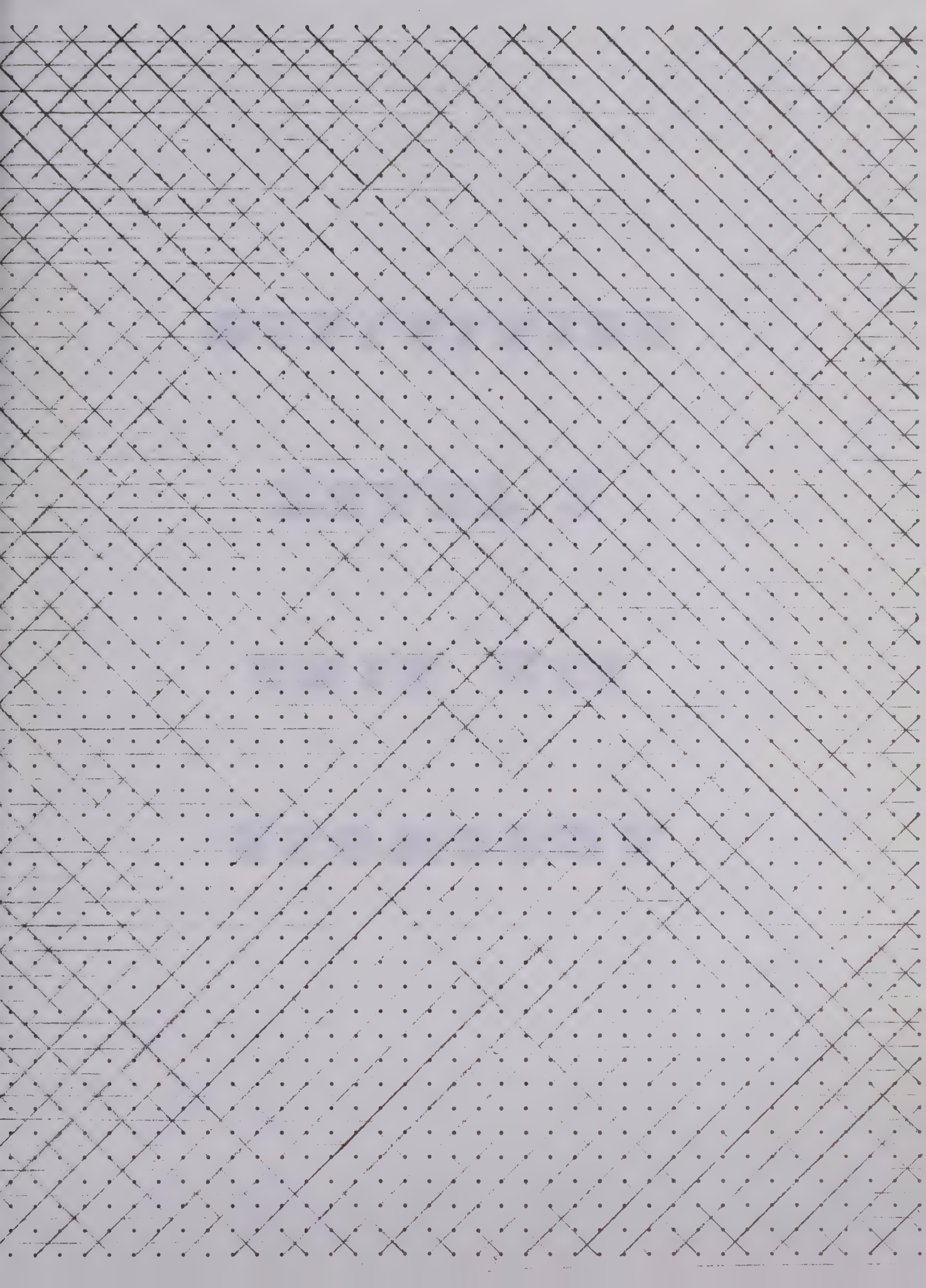
How are the polygons above classified?

APPLICATION:

1. Identify as many polygons as you can in the accompanying figure.



2. Outline polygons of various sizes and shapes on the grid paper. Classify each polygon that you outline.



ACTIVITIES

LEVEL 7

UNIT VII

GEOMETRY

Motion Mastery

OBJECT: To remove as many pieces as possible from the playing board.

GAME PARTS: The game consists of 36 squares.

- 2 WILD CARDS
- 17 ORIGINAL pieces (figure + motion instruction)
- 17 IMAGE pieces (figure only)

Players may cut out and use the squares which are printed on the following page, or they may copy the contents of the squares onto 3" x 5" file cards.

It may be helpful to put an arrow on the reverse side of each square. This will help the players place the squares all in the same direction.

HOW TO PLAY:

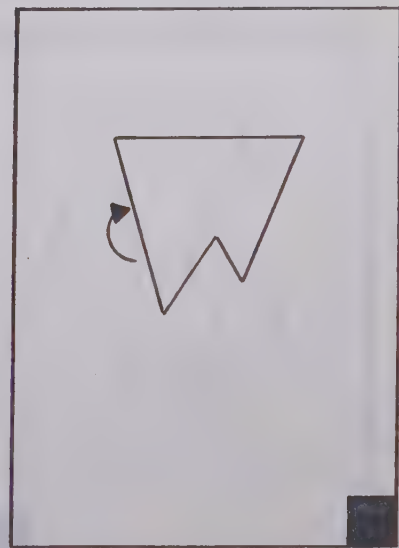
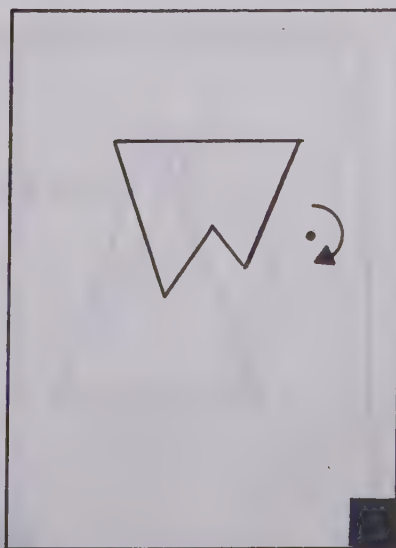
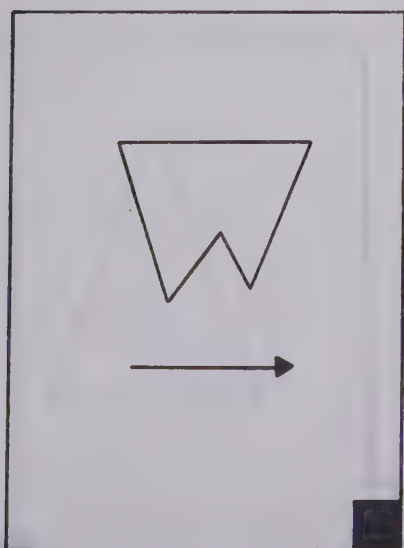
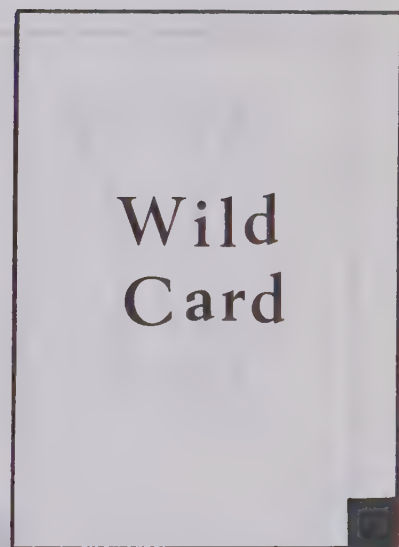
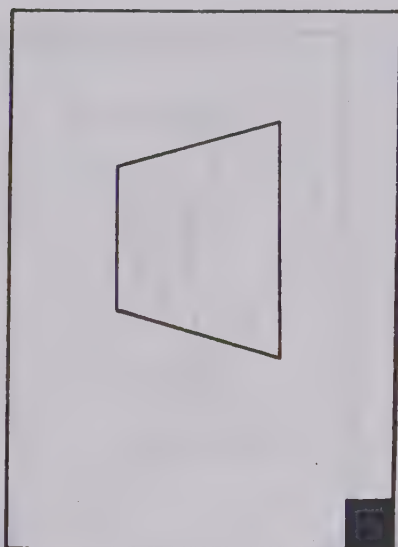
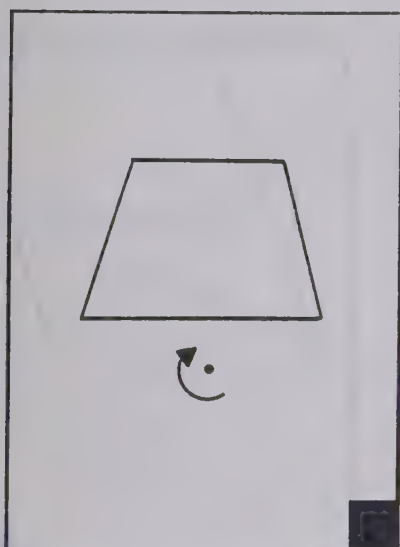
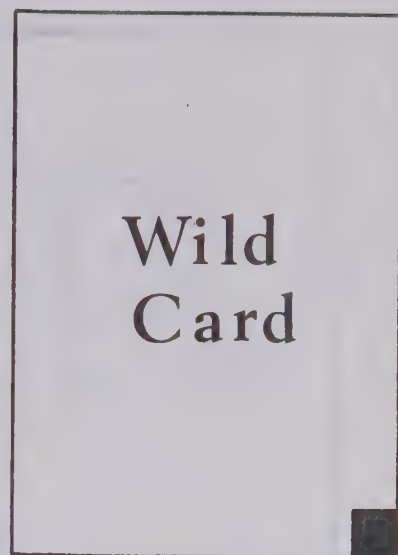
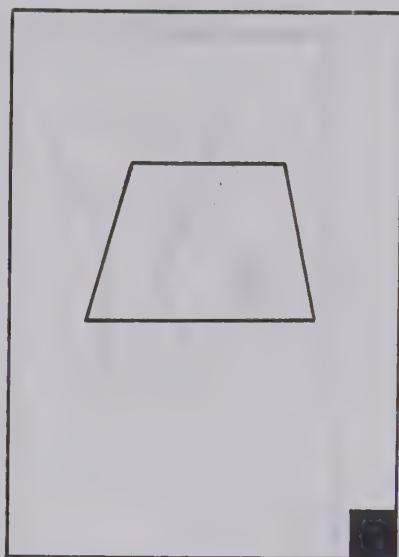
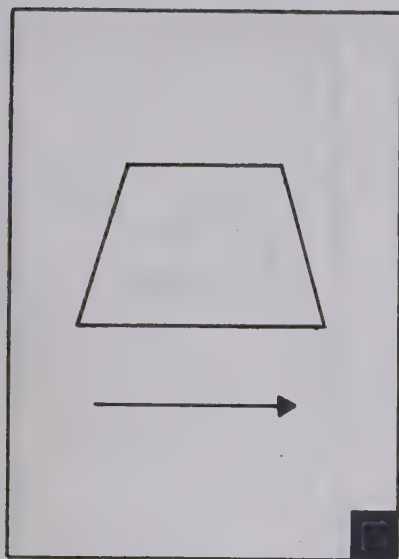
1. Shuffle the squares (or cards) and place in a 6 x 6 formation face down on a table. Make sure that all arrows point in the same direction.
2. By some means, choose a first player and determine an order for the other players.
3. The first player turns any two squares face up, making certain that the dot is in the lower right corner. If these squares form a PAIR (see below), the player removes these pieces and turns two more squares face up. This player continues until he does not form a pair. When this happens, the player returns the pieces to their original face down position. Play then passes to the next player who proceeds as the first player did. Each player is allowed to see any squares that are turned face up.
4. The game will be over whenever no more pairs can be formed by any player. (Alternate players may set a time limit).

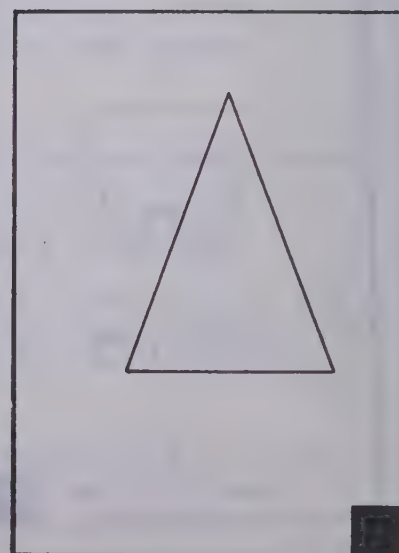
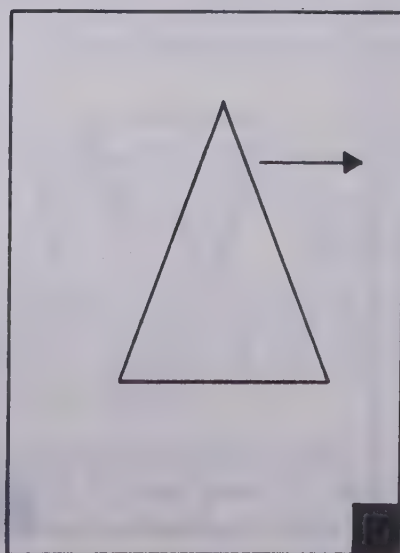
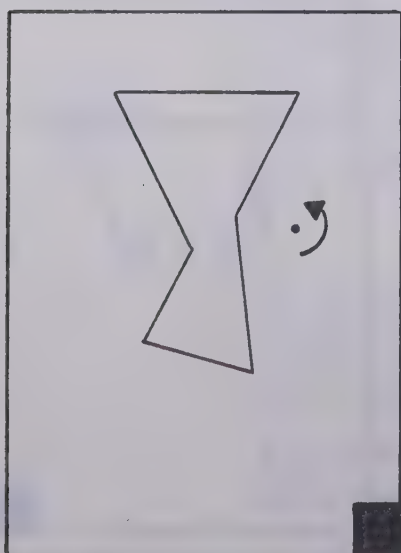
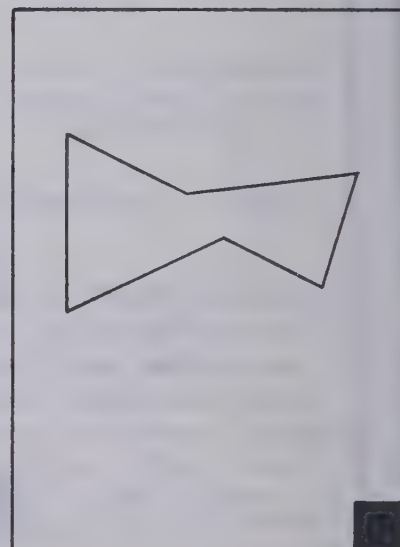
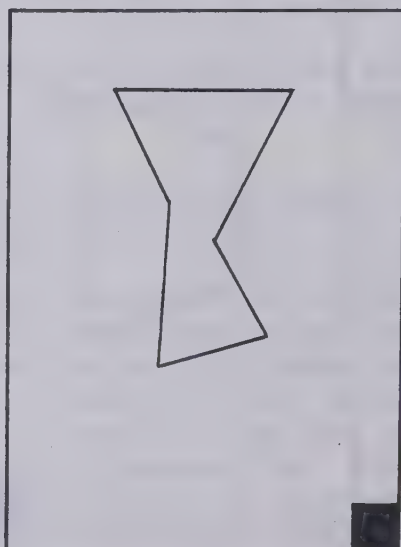
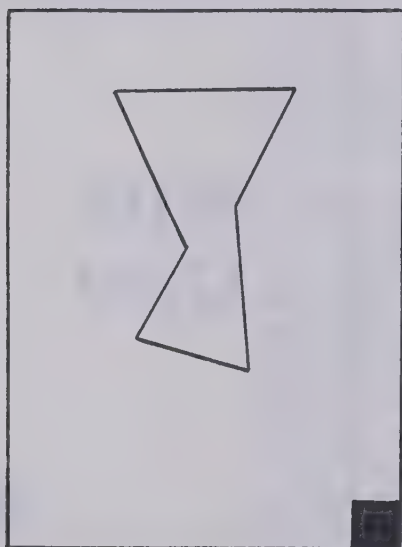
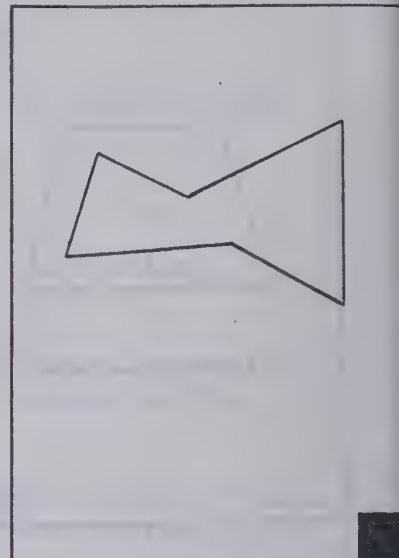
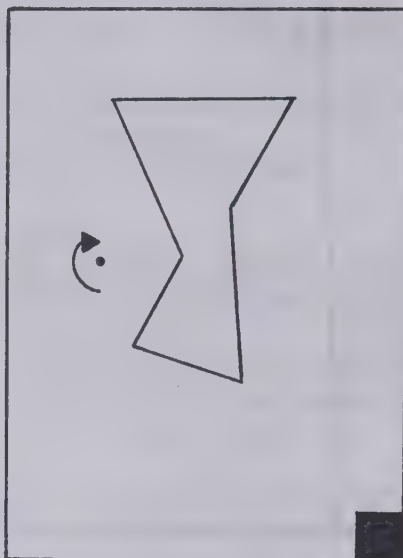
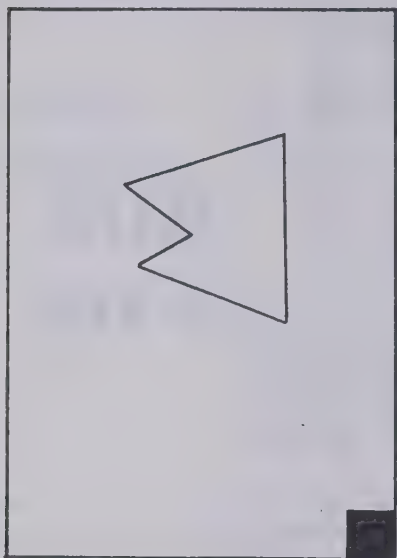
SCORING: Forming "Pairs"

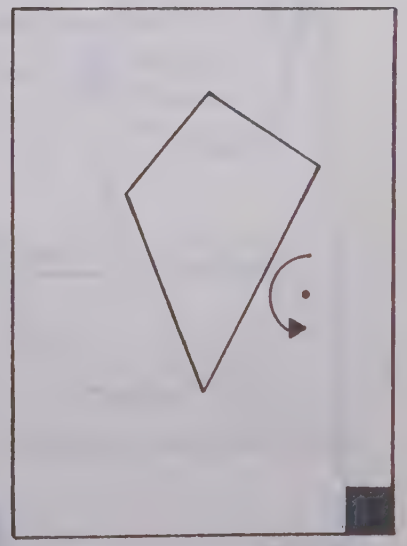
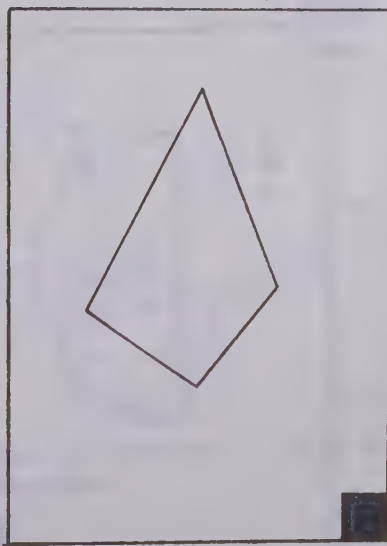
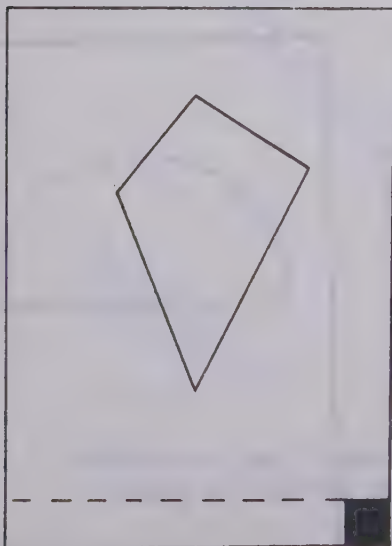
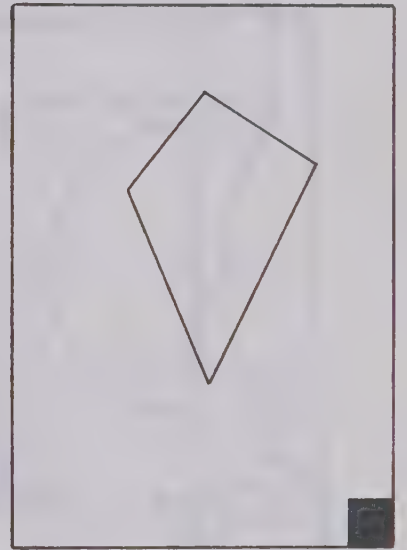
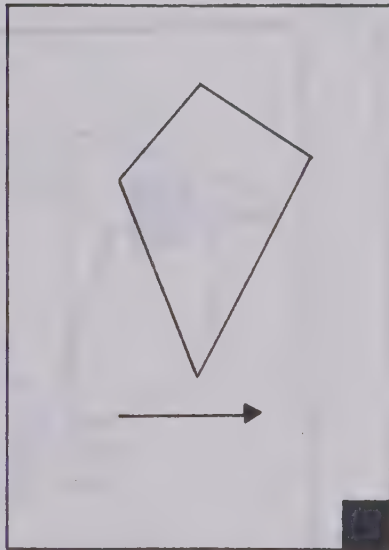
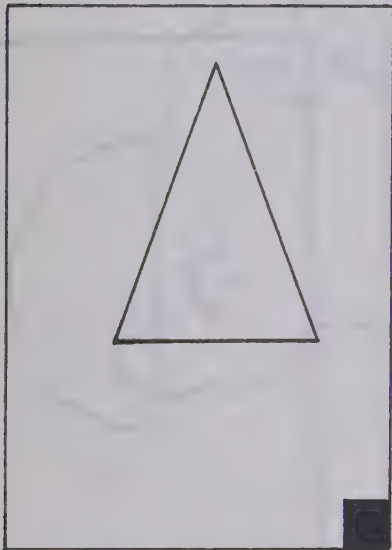
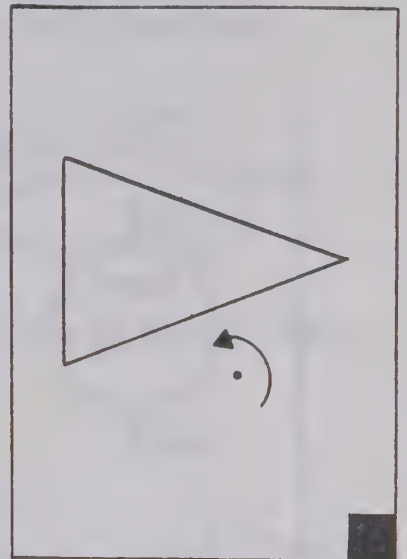
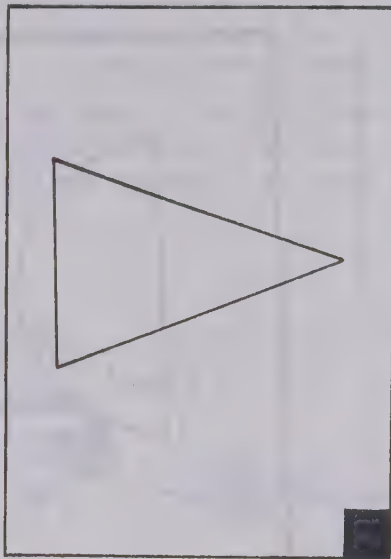
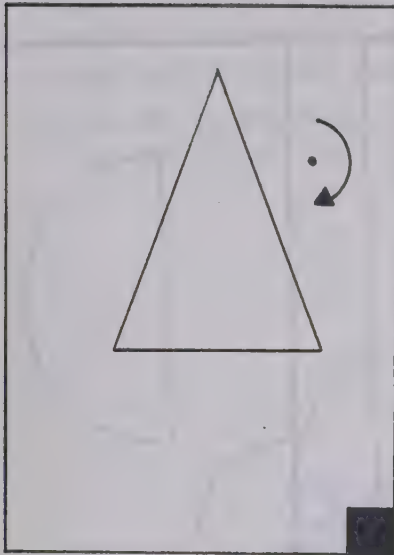
- A pair is formed by (i) a WILD CARD and any other piece.
(ii) an ORIGINAL piece and the corresponding IMAGE piece.

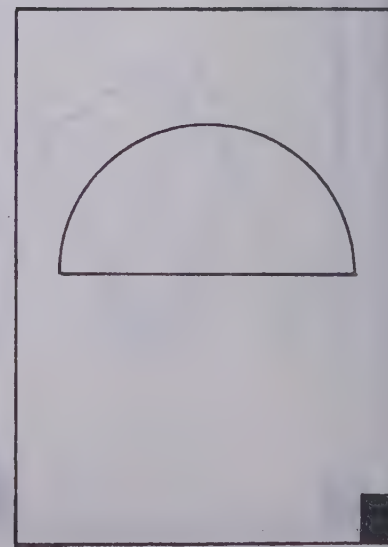
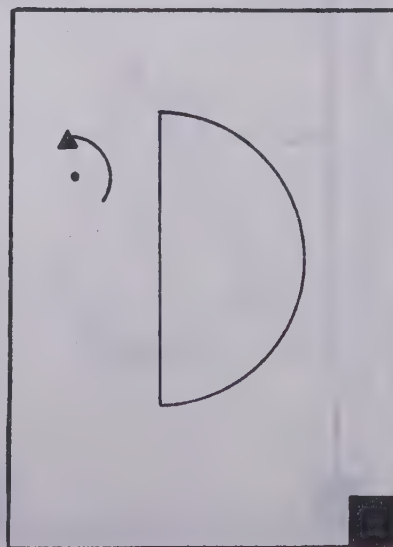
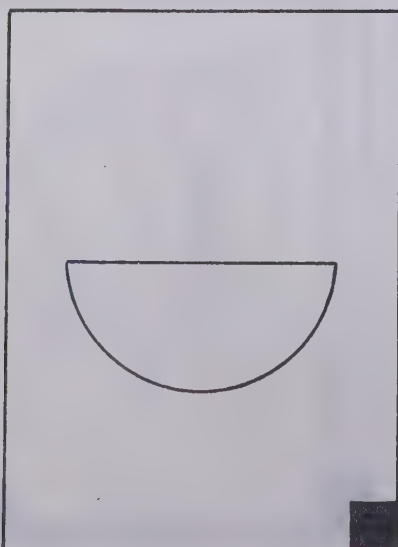
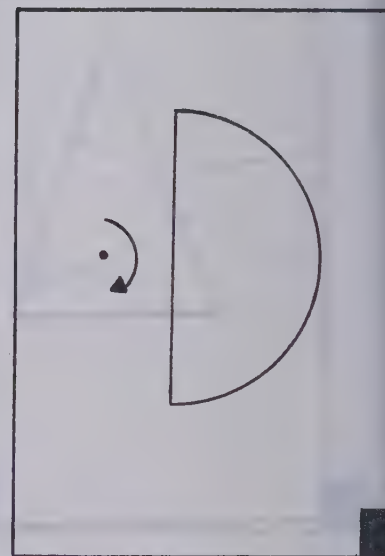
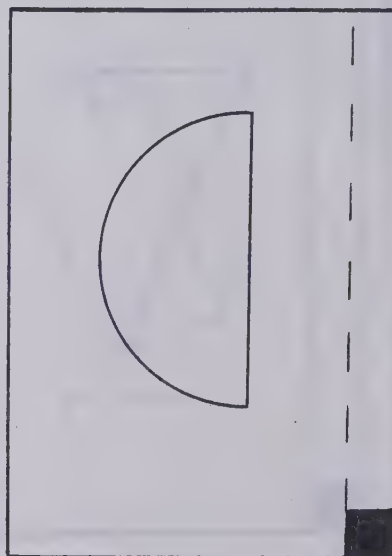
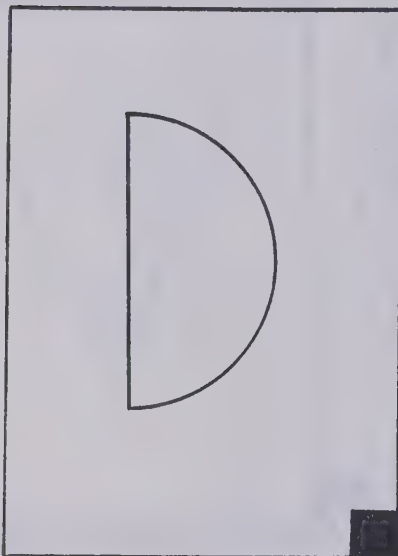
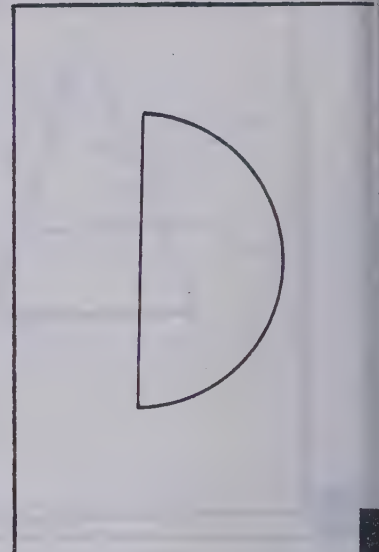
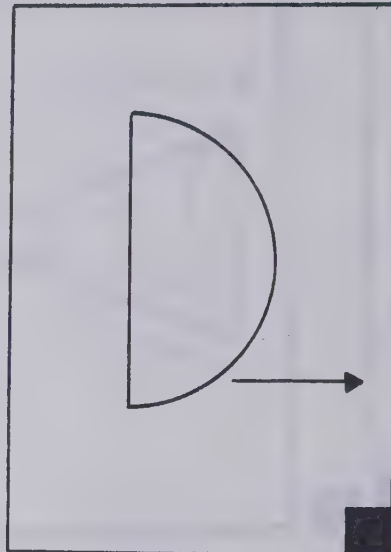
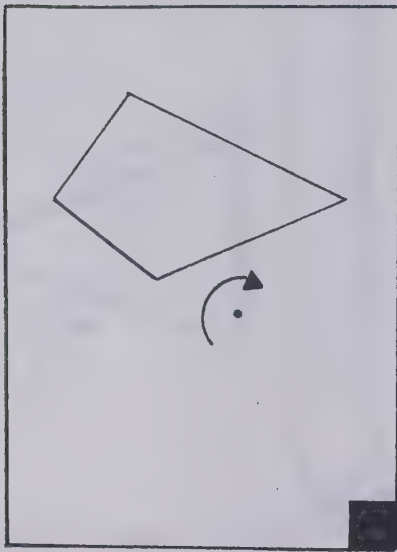
To determine whether or not a pair has been formed, follow the directions on the original piece and compare to the IMAGE piece. A pair can ONLY be formed by one original and one image when wild cards are not used.

Each pair removed counts ONE point. The player with the most points at the end of the game is declared to be the winner.





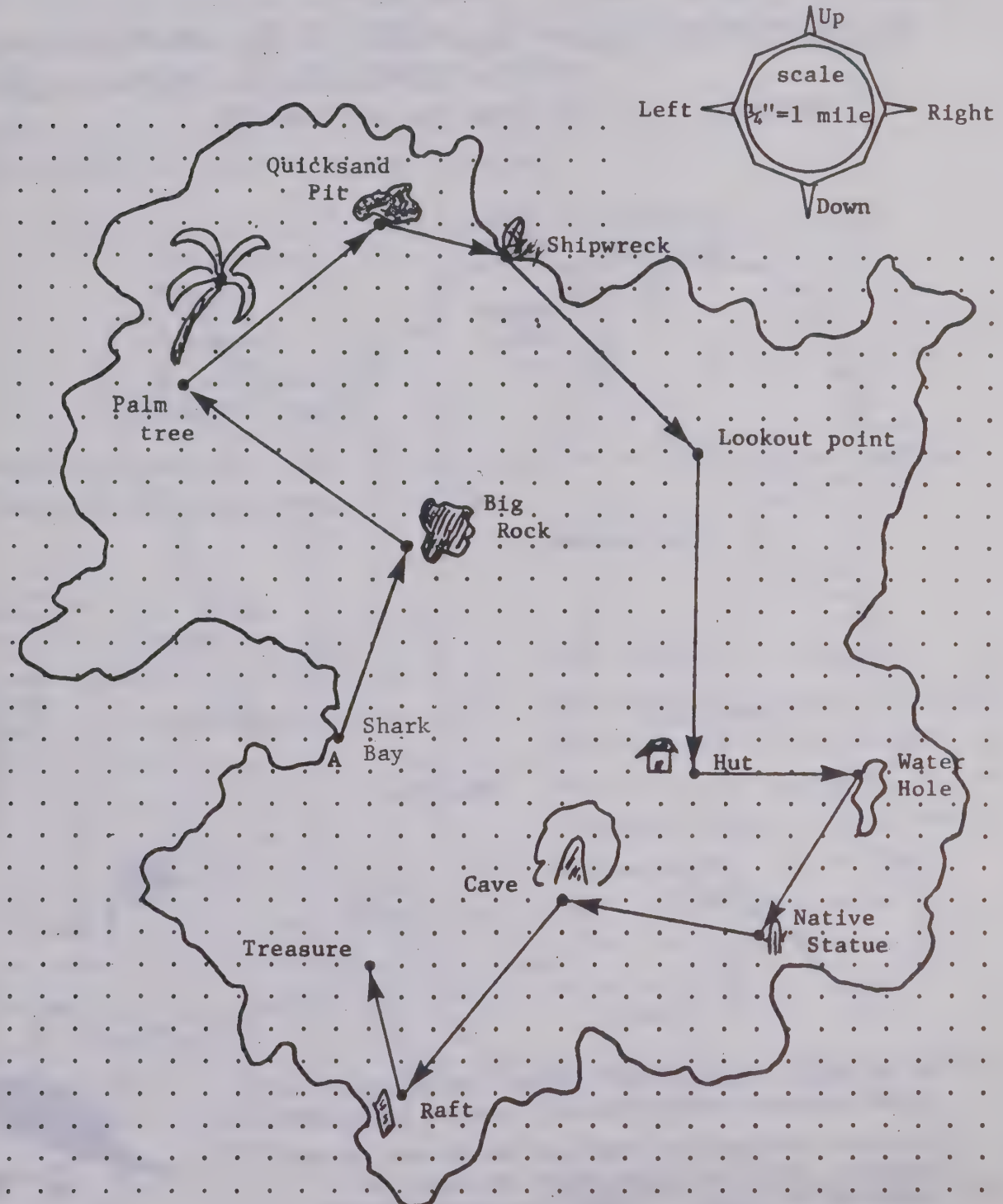




Treasure on Devil's Island

Shown below is a map of Devil's Island on which Pirate Black Bill has buried his treasure. If you land at Shark Bay (Point "A") give slide arrow notation for each part of the treasure hunt.

From "A" to Big Rock - to Palm Tree - to Quicksand Pit - to Shipwreck
 - to Lookout Point - to Hut - to Water Hole
 - to Native Statue - to Cave - to Raft - to Treasure.



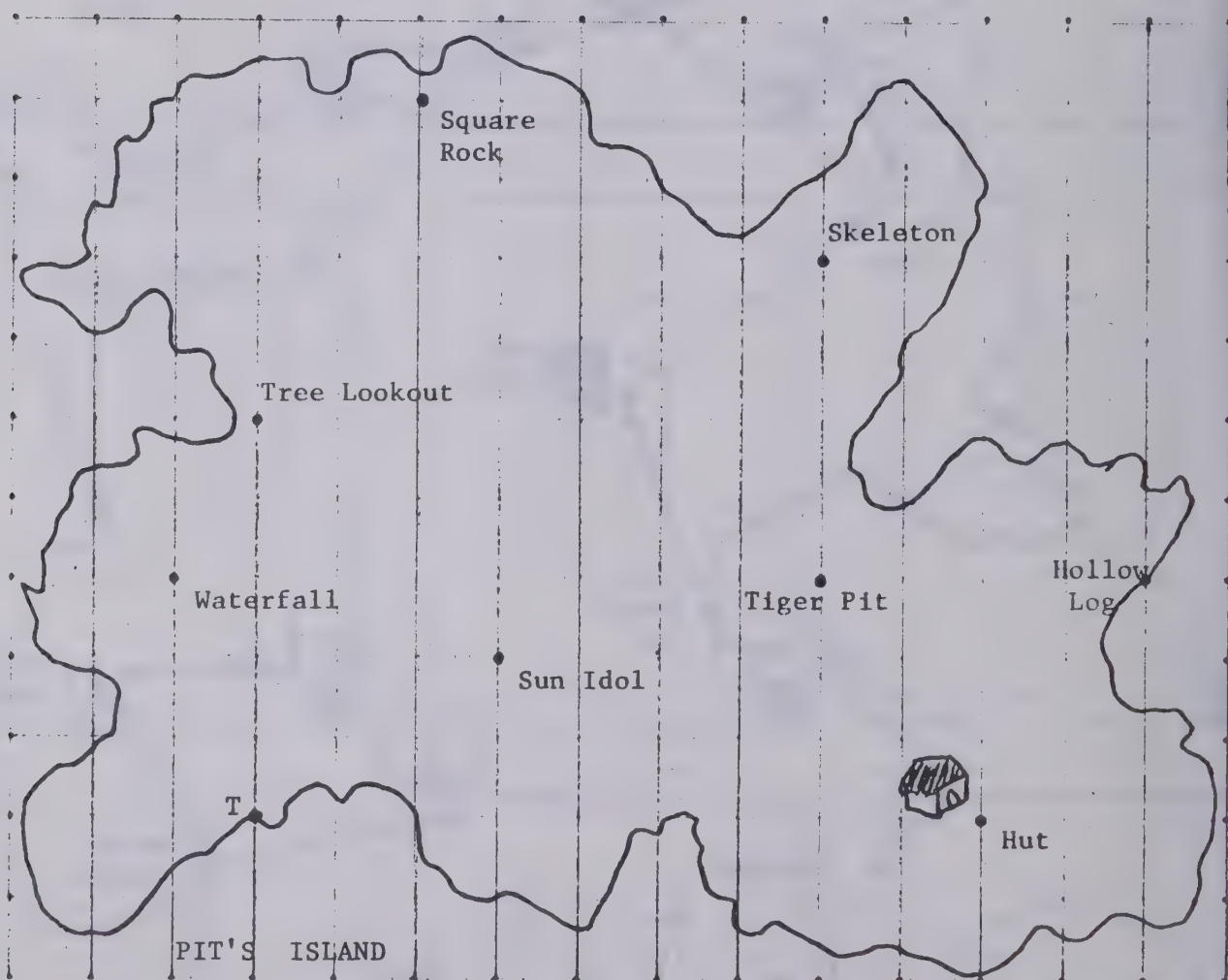
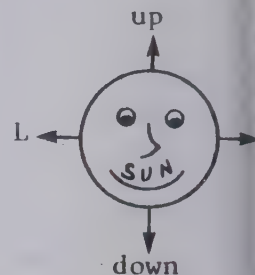
Draw your own Treasure Map, giving only slide arrow notation, and ask your friends to locate the treasure.

Pirate Blackbeard found the following map of Pit's Island. The map is not complete, but is written in code. Can you use the code to find and mark the Treasure on the map? For the Treasure Hunt, follow the code in order. Draw in slide arrows.

You land at point 'T' - (1L,3U), (1R,2U), (7R,2D), (5L,6U),
(1R,7D), (8R,1U), (4L, 0), (2R,3D).

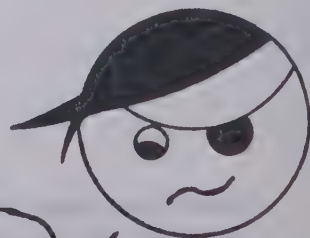
TREASURE

- 'X' marks the spot (4L,7U)



Do you reach the Sun Idol before the Square Rock?
After the Tree Lookout, which landmark comes next?

Make your own map and code and try it out on your friends. Give the slide arrow notation for returning to Point 'T' after you have located the Treasure.



AVAST!
You found it!

Up Periscope

TORPEDO-RUN GAME

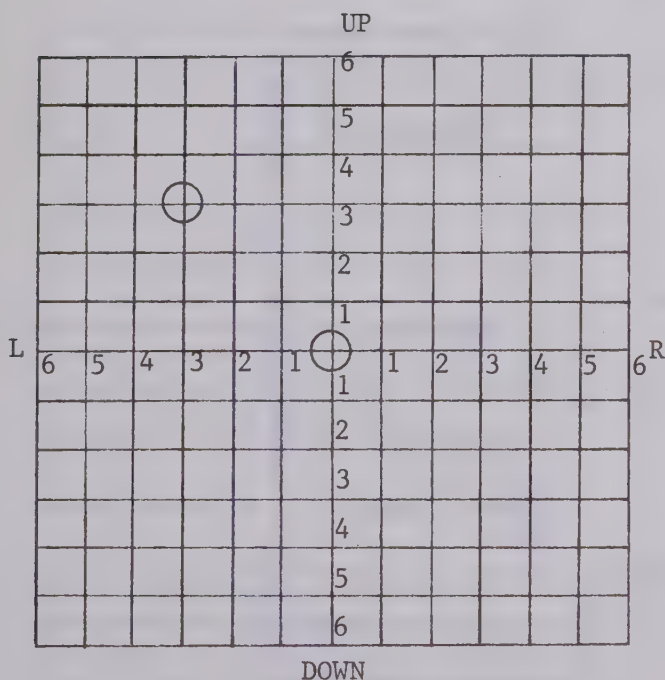
2 players

Each player needs a piece of grid paper. Players agree on how large their ocean (grid) is going to be.

Each player can have the following ships:

	Number of Circles
Battleships	3 (B) (B) (B)
Cruisers	2 (C) (C)
Destroyer	1 (D)
Aircraft-Carrier	1 (A)

Each player secretly places his four ships on his grid paper by circling the points of intersection of the lines.



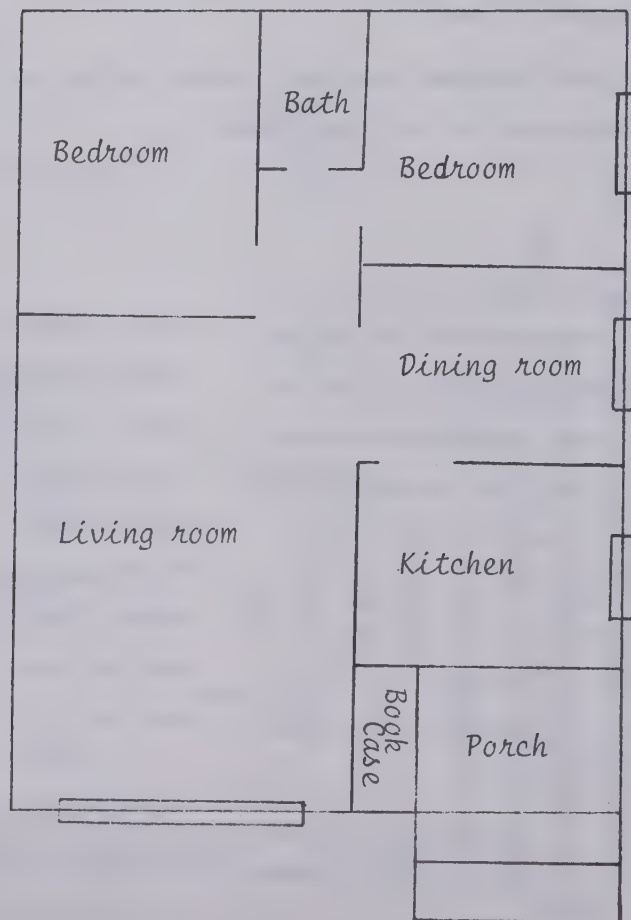
Each player has a submarine at the zero point on the grid. You would shoot a torpedo from that point by calling out two numbers to give the slide arrow notation of the motion of the torpedo. In the example above, (3L,3U) would score a hit on the destroyer. (4L,4U) would not be a hit.

You may agree on taking more than one "shot" per turn.

The winner is the first one to sink the other's fleet.

Use your mirror reflector and straight edge only for this section of work. The floor plan given represents one living quarter. Use this floor plan to construct:

1. A duplex by connecting another floor plan of the same kind to the side of the one given.
2. A fourplex by connecting two of the same kinds of plans to the back ends of the duplex.



Parallelogame

WORD CLUES

Unscramble the eight Math words below, writing each in its special box. Transfer the letters in the numbered squares to the blanks in the Joke to the right. (All words are about parallelograms).

L	A	R	L	E	A	L	P
					3		

P	O	S	I	T	P	E	O
		1					

N	A	L	G	E	S
		5			

G	A	N	A	L	I	S	D	O
				6				

S	I	C	B	E	T
		8			

R	E	G	U	T	N	O	C	N
2								

M	Y	T	R	M	S	E	Y
4							

S	T	R	A	G	I	L	E	N
				7				

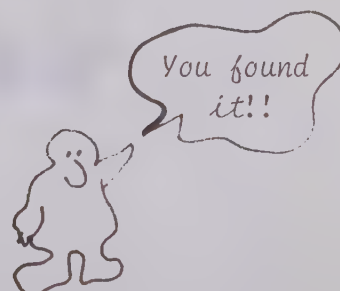
The decoded word is the
Key Word in this Math Pun.

What do parallelograms and
missing parrots have in
common?



They are both

1 2 3 4 5 6 7 8



APPLICATIONS

LEVEL 7

UNIT VII

GEOMETRY

BIBLIOGRAPHY FOR APPLICATIONS KIT

- Adler, Irving, Readings in Mathematics Book 1, Ginn and Co., Toronto, 1972
- Adler, Irving, Readings in Mathematics Book 2, Ginn and Co., Toronto, 1972
- Fadiman, Clyton, Fantasia Mathematica, Simon and Schuster, New York, 1958
- Friebel & Gingrich, Math Applications Kit, SRA, Toronto, 1971
- Horne, Sylvia, Patterns and Puzzles in Mathematics, Franklin Publications, Chicago, 1968
- Jacobs, Harold R., Mathematics a Human Endeavor, W. H. Freeman and Co., San Francisco, 1970
- Johnson, et al, Applications in Mathematics course A Scotts Foresman, Glenview, Illinois, 1972
- Johnson, et al, Applications in Mathematics course B Scotts Foresman, Glenview, Illinois, 1974
- Lyng, Meconi, Lwick, Career Mathematics: Industry and the Trades, Houghton Mifflin, Boston, 1974
- Schor, Meng, Insights and Skills Parts 1, 2 and 3, Globe Book Co., New York 1973
- Stein, Practical Applications in Mathematics, Allyn and Bacon Inc., Boston, 1972
- Witherding, Margaret F., From Fingers to Computers, Franklin Publications Inc Chicago, 1970

VIDEO TAPES

ETV Math Series produced in Ontario Tape #1 Part D

Approximating & Estimations

Good for Grade 8 Measurement Applications

Tape #3 Part B

So You Want to Buy a Car

(Application in credit buying Grade 9 level)

Tape #5 Part A

Art from Computers

Useful as maxirational unit for applying Math to Art any grade level.

GEOMETRY APPLICATIONS

LEVEL 7

UNIT VII

OBJECTIVES

Reference Section

Geometry

Students should be able to:

1. Maintain previously developed skills and ideas: point, line, ray, segment, plane, space, and their symbols. B
2. Determine whether two polygons or circles are congruent and name the corresponding congruent parts. (e.g. tracing)
3. Fill in the necessary requirements to complete diagrams for the motion of a slide using correct correspondence notation.
4. Determine whether a pair of congruent polygons were produced by a slide.
- ✓ *5. Determine one slide that is equivalent to the combination of two slides.
- ✓ 6. Determine the reflection (flip) image for any polygon when provided with the mirror line.
- ✓✓ 7. Determine the mirror line for a polygon and its mirror image.
- ✓ 8. Determine whether a pair of congruent figures were produced by a reflection.
- ✓ *9. Determine the image after a combination of two reflections. A
- ✓ 10. Obtain all the mirror symmetries for various polygons. A
11. Obtain the rotation image for any polygon. (Limit: $1/2$, $*1/4$, $*3/4$, cw, ccw.)
12. Fill in necessary requirements to complete diagrams of motion of a turn.
13. Complete an Invariance Table for the slide, reflection and $1/2$ turn.
- ✓ *14. Find the turn symmetries of a given figure.
15. Determine the rotation image for any polygon after a combination of two turns.

OBJECTIVES -Cont'd.

Reference Section

- ✓ 16. Determine whether a pair of congruent figures were produced by a turn.
17. Classify polygons. (Limit: triangles, quadrilaterals, pentagons, hexagons, octagons and decagons.)
18. Using the number of lines of symmetry, classify a triangle by its sides. NOTE: Include traditional classification.
19. Classify quadrilaterals.
20. Determine the properties for parallelograms, square, rectangle and rhombus. (Motions make this very simple.)
(Limit: (i) opposite sides congruent
 (ii) opposite angles congruent
 (iii) opposite sides parallel
 *(iv) diagonals bisect the figure
 *(v) diagonals bisect each other
 *(vi) diagonal for the square are
 congruent
 *(vii) diagonals of a square and rhombus are
 perpendicular.)
21. Identify the parts of a circle. (Limit: interior, exterior, circle, center, radius, diameter, chord, arc, semi-circle, tangent, and secant.)
22. Determine the properties for the circle. (Motions make this very simple.)
(Limit: (i) diameters bisect the circle
 (ii) diameter equals two radii
 (iii) the center is always equal distance from the
 the circle.)
- *23. ✓ Use motion geometry to design wall paper.
- *24. Use paper folding to produce stars and regular polygons.

VII GEOMETRY APPLICATIONS (7)

A. Symmetry and Reflection

1. Take five objects to a mirror. Observe their reflection at various distances.
2. List five examples of symmetry in your classroom.
3. List five examples of symmetry in your house.
4. Go to the school yard. Find five examples of symmetry.
5. On your next science field trip:
 - (a) Find five examples of symmetry in nature.
 - (b) Find a quiet spot in a stream (still water). Look at your reflection.
 - (c) With a rock tied to a string, get its reflection at various heights.
 - (d) Observe leaves from five different plants or trees. Is the vein network parallel or alternate? Are both symmetrical?
6. Perhaps include some of the following as review:
 - (a) Find examples of perpendicular lines, vertical lines, horizontal lines.
 - (b) Using your string, make a diagonal.
 - (c) Compare shadows at various times of the day.
 - (d) Compare the ratio of a height of an object to its shadow.
 - (e) Number of branches compared to its height.
 - (f) Count the number of blades of grass in 2 dm by 2 dm. Estimate the number of blades of grass in a strip 50 m by one decimeter.
 - (g) Estimate and measure various distances.
 - (h) Find the average height of the fence posts.

B. Additional applications for Grade 8 Geometry found in:

1. S.R.A. Math Applications Kit

(a) Appetizers #16

(b) Sports and Games #28, 47

(c) Everyday Things #14

2. Patterns and Puzzles in Mathematics

The Franklin Mathematics Series

- Ruler and Compass Designs, pages 36 to 43.

HISTORY

LEVEL 7

UNIT VII

GEOMETRY

REFERENCES

The Committee recommends the following references as primary sources of information for Junior High School teachers and students. We suggest that those books labelled (T) be available as teacher references and those labelled (S) be available in quantities of 3 - 5 for class use. Many of these books may be in your library now and extra copies may be borrowed from the Library Service Centre.

These references are numbered (1 - 14) for referral in the following outline:

1. Adler, Irving. The Giant Golden Book of Mathematics. Golden Press, New York, 1966
510 Ad 59g (S)
2. Adler, Irving. Readings in Mathematics (book 1). Ginn and Company, Lexington, Massachusetts, 1972.
510 Ad 59r (S)
3. Adler, Irving. Readings in Mathematics (book 2). Ginn and Company, Lexington, Massachusetts, 1972.
510 Ad 59r (S)
- ✓4. Bell, E.T. Men of Mathematics. Simon and Schuster, New York, 1966.
920 B 4134 (T)
5. Bergamini, David. Mathematics (Life Science Library). Time Inc., New York, 1966.
510 B 452 (T) and (S)
6. Denholm, Richard A. Mathematics: Man's Key to Progress (Book A) Franklin Publications Inc., Chicago, 1970
(S)
7. Denholm, Richard A. Mathematics: Man's Key to Progress (Book B) Franklin Publications Inc., Chicago, 1970.
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8. Halacy, Dan. Charles Babbage: Father of the Computer. Crowell-Collier Press, Toronto, Ontario, 1970.
921 B 113h (T) or (S)

9. Hogben, Lancelot. The Wonderful World of Mathematics. Doubleday and Company, Inc., Garden City, N.Y. 1955
510 H 679 (S)
10. Muir, Hane. Of Men and Numbers. Dodd, Mead and Co., New York, 1963
920 M 896 (S)
11. Ripley, R.D. and Tait, George, E. Mathematics Enrichment. Copp Clark Publishing Company, Toronto, 1966 (S)
12. Rogers, James T. Story of Mathematics for Young People. Pantheon Books, Random House Inc., Toronto, 1966.
510.09 R 632 (S)
13. Shaw, H. Alan and Fuge, Keri. The Story of Mathematics. Fletcher and Son Ltd., Norwich, Great Britain, 1963.
510.09 S h 26 (S)
- ✓14. Terry, Leon. The Mathmen. McGraw-Hill, New York, 1964.
510.09 T 279 (S)

SUPPLEMENTARY REFERENCES

(These are additional references for teachers)

Fadiman, Clifton, Fantasia Mathematics, Simon and Schuster, New York, 1958.

James & James, Mathematics Dictionary, 3rd ed., D. Van Nostrand Company, Inc., Toronto, 1968.

519 King, Amy C. and Read, Cecil B. Pathways to Probability, Holt,
K58 Rinehart and Winston, Inc., New York, 1963.

Marks, Robert W. The New Mathematics Dictionary and Handbook.
Bantam Books, Inc., New York, 1964.

512 N.C.T.M. Historical Topics in Algebra. National Council of
N213 Teachers of Mathematics, Washington, D.C., 1971.

Newman, James R. The World of Mathematics. (Vol. 1, 2, 3, 4)
Simon and Schuster, New York, 1956.

Smith, D.E. History of Mathematics. (Vol. 1,2) Dover
Publications, Inc., New York, 1958.

920 Turnbull, H.W. The Great Mathematicians. New York University
T849 Press, New York, 1969.

Black, Gerald J. Canada Goes Metric. Doubleday Canada Ltd.,
Toronto, 1974.

Posters

1. Walch, J.W. (Publisher) "Posters on Famous Mathematics".
Available on loan from the Library Service Centre.
2. I.B.M., Timeline "Men of Mathematics", available from I.B.M.
Library, Calgary. Ask for Item #5050003. (Free)

Busts

"Mathematicians of the Century", available from Moyer. Available
on loan from the Library Service Centre. (Price \$48.00)

Movies

CK "Possibly So Pythagoras". Available on loan from Instructional
10591 Aids Department.

CK "Donald Duck in Math Magic Land". Instructional Aids.
538

Games

1. Euclid. Western Educational Activities. For advanced students.

The resource list on Posters, Busts, Movies and Games was taken from Men of Mathematics - A Resource Unit developed by J. Barnes.

E. T. V. Math Series (Produced in Ontario). Available from Central Office.

Tape #3 part (a) Square Root: Newton's Method. (Time 20 min., 275 ft.)

Useful for introducing square roots in grades 8 or 9.

Tape #5 part (b) History of Computers.

Useful as a motivational unit.

Tape #5 part (f) Number Systems.

Useful for introducing number theory, grade 7.

Tape #6 part (a) History of Numerals

Useful in grade 7 whole numbers.

Tape #6 part (b) History of π .

Grade 9 geometry.

Tape #6 part (c) From Time to Time

Development of calendar.

Tape #6 part (f) History of India(n) Mathematics

Laid the basis for our present number system and useful in History of Math in an option.

Tape #7 part (a) Inverse Variation

Grade 9 functions.

Tape #7 part (b) Graphs

Grade 8 coordinate system (Descarte).

Tape #9 part (a) Fibonacci Sequence

Grade 8 real numbers.

Tape #9 part (b) The Divine Proportion: Golden Section

Grade 9 geometry.

Tape #9 part (c) Map Making

Useful for upper ability students in grade 9 solid geometry.

Tape #10 part (c) What are Numbers

History of development of number systems. Useful as an introduction to grade 7 number systems.

LEVEL 7

UNIT VII

OBJECTIVES

Reference
Section

Geometry

Students should be able to:

1. Maintain previously developed skills and ideas: point, line, ray, segment, plane, space, and their symbols.
2. Determine whether two polygons or circles are congruent and name the corresponding congruent parts. (e.g. tracing)
3. Fill in the necessary requirements to complete diagrams for the motion of a slide using correct correspondence notation.
4. Determine whether a pair of congruent polygons were produced by a slide.
- *5. Determine one slide that is equivalent to the combination of two slides.
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7. Determine the mirror line for a polygon and its mirror image.
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- *9. Determine the image after a combination of two reflections.
10. Obtain all the mirror symmetries for various polygons.
11. Obtain the rotation image for any polygon. (Limit: $1/2$, $*1/4$, $*3/4$, cw, ccw.)
12. Fill in necessary requirements to complete diagrams of motion of a turn.
13. Complete an Invariance Table for the slide, reflection and $1/2$ turn.
- *14. Find the turn symmetries of a given figure.
15. Determine the rotation image for any polygon after a combination of two turns.

B

A

A

OBJECTIVES -Cont'd.Reference
Section

16. Determine whether a pair of congruent figures were produced by a turn.
17. Classify polygons. (Limit: triangles, quadrilaterals, pentagons, hexagons, octagons and decagons.)
18. Using the number of lines of symmetry, classify a triangle by its sides. NOTE: Include traditional classification.
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(Limit: (i) opposite sides congruent
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*(iv) diagonals bisect the figure
*(v) diagonals bisect each other
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22. Determine the properties for the circle. (Motions make this very simple.)
(Limit: (i) diameters bisect the circle
(ii) diameter equals two radii
(iii) the center is always equal distance from the the circle.)
- *23. Use motion geometry to design wall paper.
- *24. Use paper folding to produce stars and regular polygons.
25. Develop an appreciation in Euclidean geometry.
26. Recognize geometry in art.

3

1

2

UNIT VII:

GEOMETRY (7)

RESOURCES

Albrecht Durer (1471 - 1528) - "Geometry is the right foundation of painting"

Reference #1, Pages 79-80

Euclid (350 - 275 B.C.) - Father of modern geometry.

Reference #14, Pages 147-156

Reference #11, Page 2

Reference #6, Pages 60-62

Reference #2, Page 65 (Wit of Euclid)

Reference #12, Pages 46-50

UNIT VII:

GEOMETRY (7)

ACTIVITIES

1. (a) Euclid was the author of the World's most famous textbook.

What was the name of this book?

What was it about?

How long has it been used?

What was the original book written on?

- (b) Euclid is known for his famous sayings. Read page 65 in Readings in Mathematics (reference #2).

The Mathmen (reference #14) pages 147-162

Mathematics: Man's Key to Progress (reference #6) pages 60-61

Mathematics Enrichment (reference #11) page 2

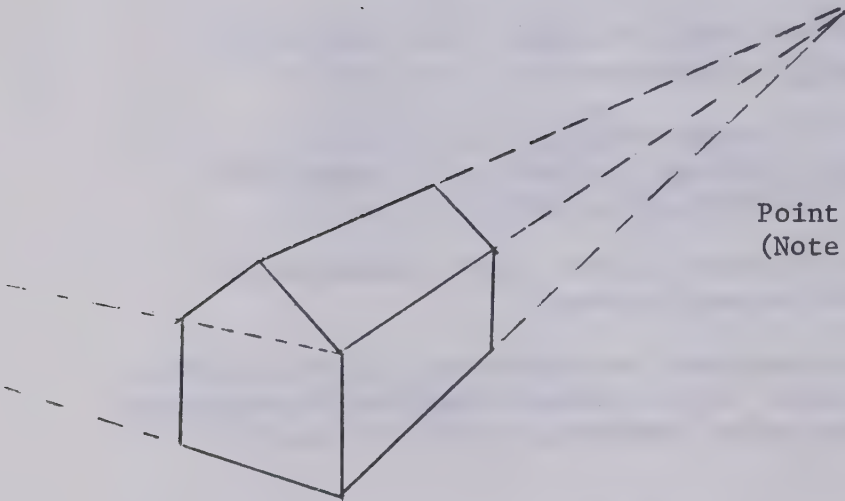
2. (a) Albrecht Durer said "Geometry is the right foundation of painting". What did he mean by this?
- (b) Make some posters to decorate the classroom illustrating the use of geometry in art. Try to include examples of projective geometry, the golden ratio, symmetry, spirals and curve stitching.
- (c) Albrecht Durer was the first person to use the following technique to create drawings. The technique involves the use of projective geometry and ratio. Try it yourself.

Steps:

1. Select a window at home or school where you can look out at a neighbour's house across the street. (You should not be looking directly at one side only of the house).
2. Use masking tape to divide the window into squares (likely about 1 dm^2).
3. Draw the same number of squares on a piece of art paper.
4. Set up a working area (chair and table) so that you can see the house you will reproduce in your picture.

5. Sketch the picture in each square as it appears across in reality.
6. After you have completed the picture extend the lines on your picture of the house until they meet.

i.e.



Point of perspectivity
(Note: there is more than one
point of perspectivity)

The Giant Golden Book of Math (reference #1) page 80
Mathematics (reference #5) pages 88-101
Mathematics Enrichment (reference #11) pages 103, 108-117

3. Read "Who First Measured the Size of the Earth" in Readings in Mathematics, Book 1. Pages 164-165.

LEVEL 7SUPPLEMENTARY UNITSOBJECTIVESUNIT VIII SIGNIFICANCE OF MATHEMATICSReference
Activities

1. Understand the effect of mathematics in other disciplines (i.e. music).
2. Develop an understanding of mathematics as a creation of man and to develop an appreciation of the contribution of this discipline to the progress of civilization.

1, 3, 4

1, 2, 3, 4

UNIT VIII

SIGNIFICANCE OF MATHEMATICS

RESOURCES

Pythagoras (567 - 497 B.C.) - Applied mathematics to music

Reference #14, Pages 59-60

Reference #1, Pages 77-78

Reference #5, Pages 42-43

Albrecht Durer (1471 - 1528) - Applied mathematics to art and design.

Reference #5, Pages 94-104 (specifically page 101)

Reference #1, Pages 77-80

Piet Mondrian (1872 - 1944) - Used golden rectangles in painting.

Reference #5, Page 97

UNIT VIII

SIGNIFICANCE OF MATHEMATICS

ACTIVITIES

1. (a) Pythagoras applied mathematics to music. This helped in the development of more complex musical instruments. What were some of his discoveries?
- (b) Make a device for finding tones in a scale. (page 78 in The Giant Golden Book of Math - reference #1).
- (c) What is the frequency of the following notes: F. C. G. D, A, E, B?
- (d) In stringed instruments, how would you:
produce a dominant tone?
get a note one octave higher?
- (e) Design and/or construct a simple stringed instrument or a xylophone. Use mathematics to plan your instrument.
- (f) What is harmonic proportion?

References:

The Giant Golden Book of Mathematics (Reference #1) pages 77-78
Mathematics (Reference #5) pages 43-43
The Wonderful World of Mathematics (Reference #9) page 38

2. Choose 5 Math Men. One from Early Civilization, one from Middle Ages, one from Contemporary. Record their contribution. Does it have any significance with the events of their society?
3. Many artists used math in their creations. Try the following activities:

Unit III - Activity #5 Gr. VIII
Unit VII - Activity #2 Gr. VII

**JUNIOR HIGH
MATHEMATICS
PROGRAM**

GEOMETRY

LEVEL 7

UNIT VII

VII - GEOMETRY

PERFORMANCE OBJECTIVES

Students should be able to:

1. Maintain previously developed skills and ideas: point, line, ray, segment, plane, space, and their symbols.
2. Determine whether two polygons or circles are congruent and name the corresponding congruent parts. (e.g. tracing.)
3. Fill in the necessary requirements to complete diagrams for the motion of a slide using correct correspondence notation.
4. Determine whether a pair of congruent polygons were produced by a slide.
- *5. Determine one slide that is equivalent to the combination of two slides.
6. Determine the reflection (flip) image for any polygon when provided with the mirror line.
7. Determine the mirror line for a polygon and its mirror image.
8. Determine whether a pair of congruent figures were produced by a reflection.
- *9. Determine the reflection image for any polygon after a combination of two reflections.
10. Obtain all the mirror symmetries for various polygons.
11. Obtain the rotation image for any polygon. (Limit: $1/2$, $^*1/4$, $^*3/4$, cw, ccw.)
12. Fill in necessary requirements to complete diagrams for the motion of a turn.
13. Find the turn symmetries of a given figure.
- *14. Determine the rotation image for any polygon after a combination of two turns.
15. Determine whether a pair of congruent figures were produced by a turn.
16. Complete an Invariance Table for the slide, reflection and one-half turn.

7. Classify polygons. (Limit: triangles, quadrilaterals, pentagons, hexagons, octagons, and decagons.)
8. Using the number of lines of symmetry classify a triangle by its sides. NOTE: Include traditional classification.
9. Classify quadrilaterals.
10. Determine the properties for parallelograms, square, rectangle, and rhombus. (Motions make this very simple.)

(Limit: (i) opposite sides congruent
 (ii) opposite angles congruent
 (iii) opposite sides parallel
 *(iv) diagonals bisect the figure
 *(v) diagonals bisect each other
 *(vi) diagonals for the square are congruent
 *(vii) diagonals of a square and rhombus are perpendicular.)
21. Identify the parts of a circle. (Limit: interior, exterior, circle, center, radius, diameter, chord, arc, semi-circle, tangent, and secant.)
22. Determine the properties for the circle. (Motions make this very simple.)

(Limit: (i) diameters bisect the circle
 (ii) diameter equals two radii
 (iii) the center is always equal distance from the circle.)
23. Use motion geometry to design wall paper.
24. Use paper folding to produce stars and regular polygons.



**LEARNING
PACKAGE**

LEVEL 7

UNIT VII

GEOMETRY

STRAND: GeometryLEVEL: 7UNIT: VIIOBJECTIVE NO: 1

OBJECTIVE: Maintain previously developed skills and ideas: point, line,
ray, segment, plane, space, and their symbols.

Note: The article is intended to be read aloud, with emphasis points where words are capitalized. Drawing on an overhead may be valuable.

A LEGEND (or Motion Mystery)

Article:

Part of the First:

Not so very long ago, it came to pass that a strange and wonderful event happened to a group of boys and girls in a country not too far from Canada.

The group was sitting in a forest clearing, contemplating nature and their lives, when an amazing thing happened. A very tiny black dot (.) appeared in front of a boy named Ray. Ray was very surprised by this and began to POINT his finger. Soon the whole group were POINTING their fingers at this strange thing.

Even to this day, a tiny dot in space is called a POINT.

Part of the Second:

The very next time the group gathered at their clearing another amazing event happened again, as mysteriously as before, another point magically appeared. However, in this instance there was a difference. Not one point appeared, not two, not three, but so many that the group could not count them all. Excitedly, the group each picked up a handful of the points and ran toward their village. Since there was only one very narrow path leading out of the forest, the group had to run in a row, one behind the other.

By the time they reached their village all the points had mysteriously disappeared. The village elders refused to believe such a thing had happened.

Skeptically, the chief said "Oh come, come now". What kind of LINE are you trying to hand your elders?"

Even to this day, a whole lot of points all in a row is called A LINE.

..... line

Part of the Third:

Remember Ray in the first story? Well, it just so happened that Ray wanted very much to become famous. He got his wish.

Ray realized that he was the first one of his tribe to notice the existence of points. He declared aloud one day at a council meeting, "All points START from me! Without me, there would be no lines. I'm very important! "

Even to this day, that object which begins at one point and continues on forever in one direction is called a RAY.

.....→ ray

Part of the Fourth:

We all know about Ray, the group's most brilliant member, but there was a less brilliant member who became nearly as famous as Ray. This fellow was called Seggie.

Seggie had the mistaken idea that a line was the distance between two points. The rest of the group asked what he meant by this.

Sensing that he was mistaken and hoping to cover up his error, Seggie said, "I meant that a line is a short distance; that is exactly the distance between two points".

He hoped this would clear up what he meant, but the group persuaded him that he was wrong. Finally, even Seggie had to admit he was thinking of something else. SEGGIE MEANT a thing which was not a line, since a line has no ends.

Even to this day, a part of a line between two points is called a SEGMENT.

..... segment

Part of the Fifth:

On yet another day, whilst the group was busy playing with their ideas about points, lines, rays, and segments, a very serious minded girl whose name was Jane noticed that occasionally special things happened to points.

If Jane watched any two points, she could see one line. If Jane watched any three points, she could see three lines, and further these lines formed the boundary of a large flat surface. Now this was amazing to Jane. The result of the group's play produced this vision.

However, when she proclaimed her proud discovery to the village elders, they merely scoffed and said, "Oh come on now, this is not amazing at all. You and your group are just PLAYIN' Jane."

Even to this day, the set of points which form a large flat surface is called a PLANE.



Part of the Sixth:

One day as dusk was covering the forest, the group had a frightening experience. Ray, Seggie, Plane Jane, and all the others were just about to return to their village when suddenly vast numbers of points began to appear. In fact, there became so many points that the group, fearing for their lives, ran hurriedly off to the safety of their village.

The group stopped only once during their flight. That stop was to look back at the clearing they had just left. They noticed the entire clearing was overflowing with points.

Ray remarked to Seggie, "With all those points, there is just no SPACE for our group".

Even to this day, the collection of all possible points is called SPACE.

Part of the End:

And so the legend is at an end. It is sad to leave the group when they are in the midst of such important discoveries, but no information has come to us since the clearing filled with points.

At this point, we shall leave the group to their own resources to overcome their problems.

EXERCISES:

OBJECTIVE NO. 1

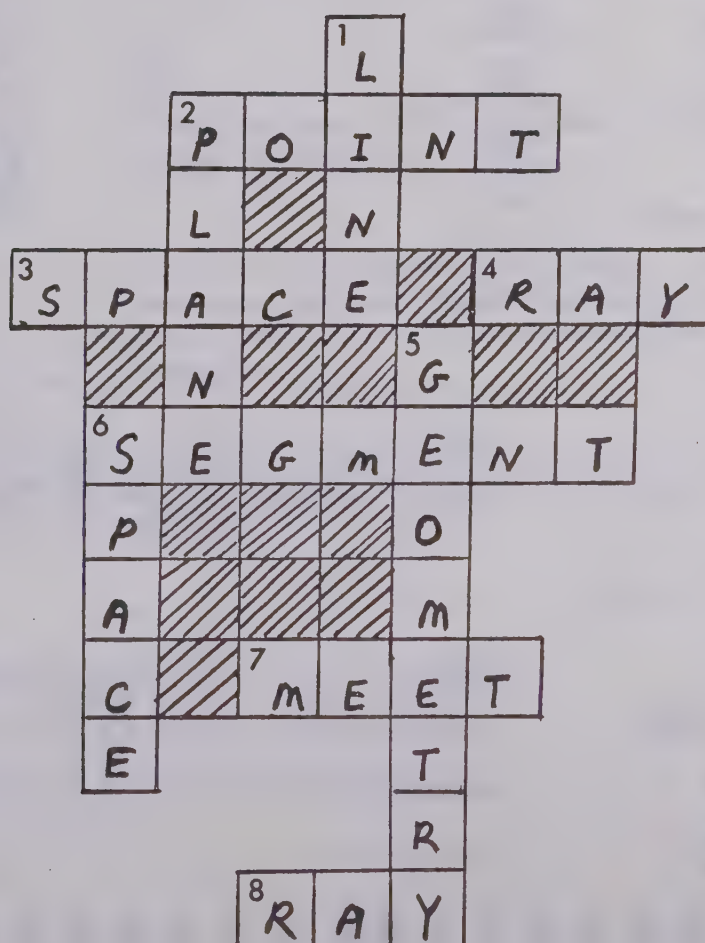
A. CROSSWORD PUZZLE: Use the clues below to complete the puzzle.

DOWN

1. Many points all in a row.
2. A very large flat surface.
5. The topic you are about to study.
6. The set of all possible points in a universe.

ACROSS

2. A very tiny place, usually written .
3. Something that covers everything. (outer _____)
4. Half a line.
6. The part of a line between two points (symbol \overline{AB})
7. Two lines _____ at a point.
8. The object whose symbol is \overrightarrow{AB} .



B. FIND THE HIDDEN MESSAGE

First: Match the symbols or definitions in column 2 with the terms in column 1, by placing a letter of the Greek Alphabet in the appropriate blank.

Second: Place the Greek letters into the corresponding boxes.

Third: Change each Greek letter to a letter from the English Alphabet using the decoder key. Then replace each number in the message by an English letter and you will find the HIDDEN MESSAGE.

<u>COLUMN 1</u>		<u>COLUMN 2</u>	
1. Ray	Δ	Γ	- 90°
2. Congruent to	π	Θ	- $\ell_1 \parallel \ell_2$
3. Angle	\times	Σ	- \overline{AB}
4. Line	\wedge	Φ	- Infinite
5. Parallel to	Θ	Ψ	- Dot
6. Segment	Σ	Ω	- 3 points
7. Space	Φ	π	- \approx
8. Point	Ψ	Δ	- \overrightarrow{CD}
9. Right Angle	Γ	\wedge	- \overleftrightarrow{PT}
10. Plane	Ω	\times	- \angle ANG

1	2	3	4	5	6	7	8	9	10
Δ	π	\times	\wedge	Θ	Σ	Φ	Ψ	Γ	Ω

Decoder Key:

π	Ψ	Δ	\wedge	\times	Ω	Θ	Γ	Σ	Φ
K	M	O	Y	I	S	T	G	E	R

Message:

G E O M E T R Y I S G R E E K T O M E
 9 6 1 8 6 5 7 4 3 10 9 7 6 6 2 5 1 8 6

DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

UNIT: VII

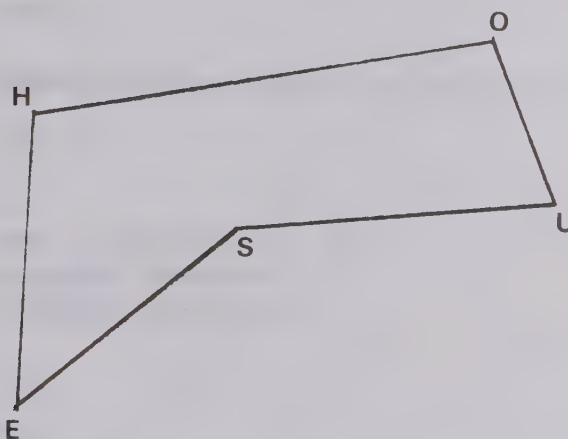
OBJECTIVE NO: 2

OBJECTIVE: Determine whether two polygons or circles are congruent (tracing)
and name the corresponding congruent parts.

Materials: Tracing paper (plain paper)

SUGGESTED DEVELOPMENT: Objects are congruent if they have the same size and shape.

1. Draw polygon HOUSE on the overhead projector:



2. Trace polygon HOUSE and label the tracing using prime notation ($H' O' U' S' E'$).
3. Discuss the relationship between the tracing and the original (Same Size and Shape \therefore Congruent). Point out that a tracing is sufficient to show congruence.
4. Set up a "Goes To" table showing the one-to-one correspondence between the original and the tracing.

H	→	H'	(H goes to H')
O	→	O'	
U	→	U'	
S	→	S'	
E	→	E'	

5. Use the "Goes To" table to identify corresponding congruent parts:

$$\text{eg. } \angle \text{HOU} \cong \angle \text{H' O' U'}$$

$$\overline{\text{US}} \cong \overline{\text{U' S'}}$$

$$\angle \text{SEH} \cong \angle \text{S' E' H'}$$

6. Have students draw triangle CAT and trace it.
7. Have students label the tracing to fit the following "Goes To" table.

$$\text{C} \longrightarrow \text{D} \quad (\text{C goes to D})$$

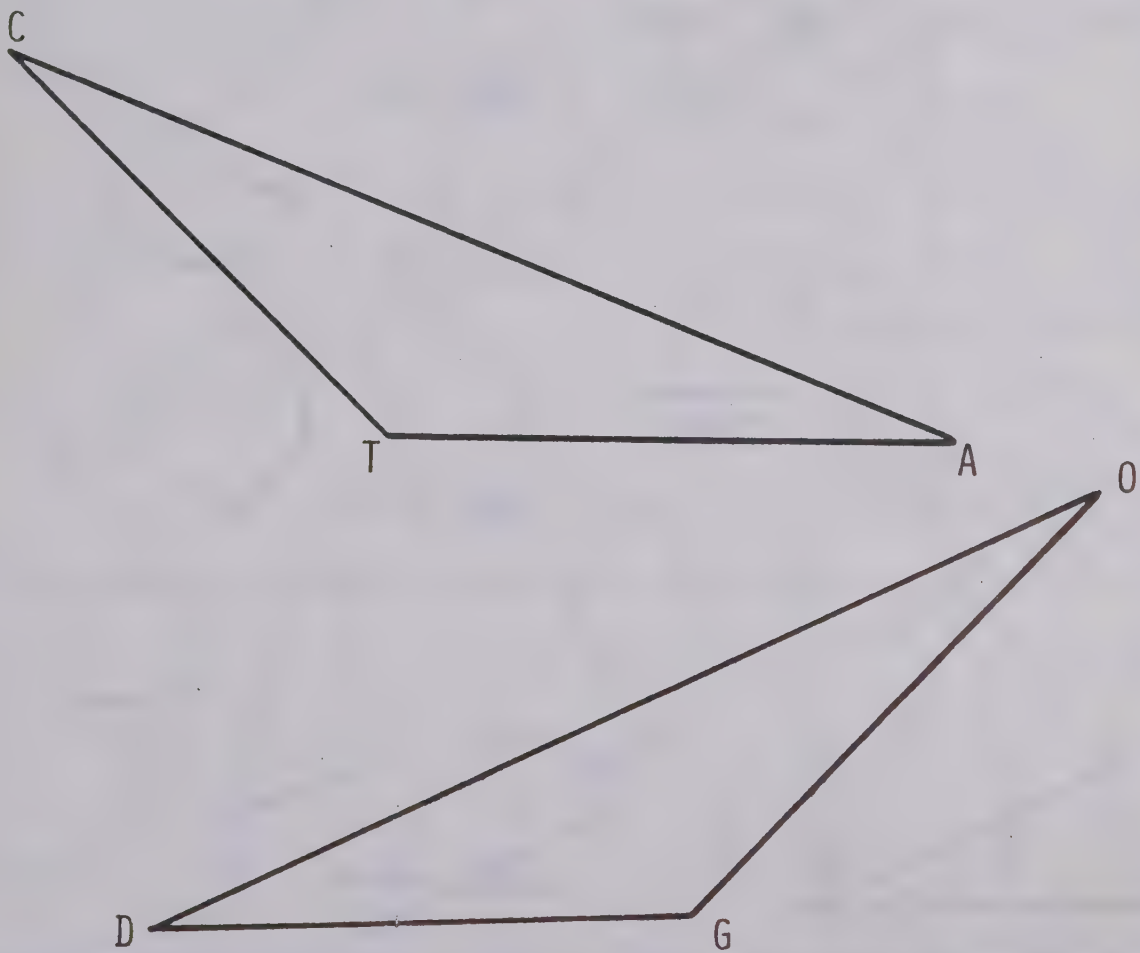
$$\text{A} \longrightarrow \text{O}$$

$$\text{T} \longrightarrow \text{G}$$

8. Have students name the three corresponding congruent angles and the three corresponding congruent segments.

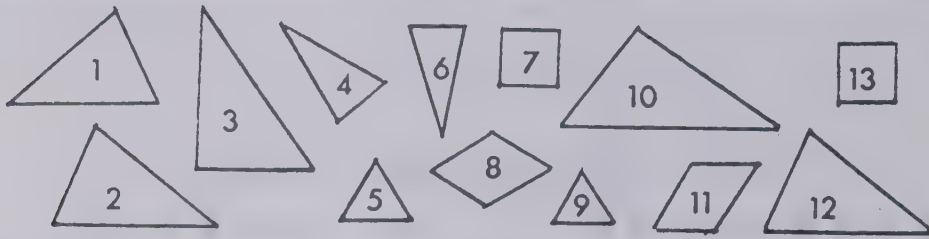
CONGRUENCE

TWO POLYGONS ARE
CONGRUENT IF A TRACING
OF ONE FITS EXACTLY
ON THE OTHER



EXERCISES:OBJECTIVE NO. 2

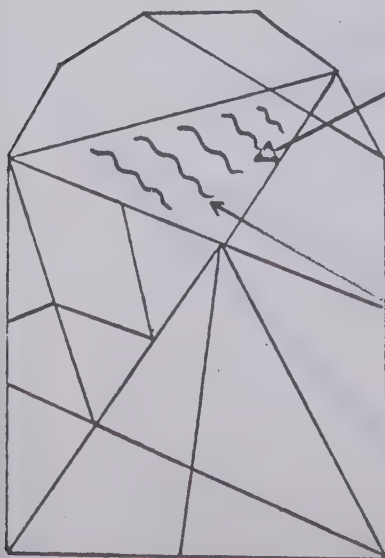
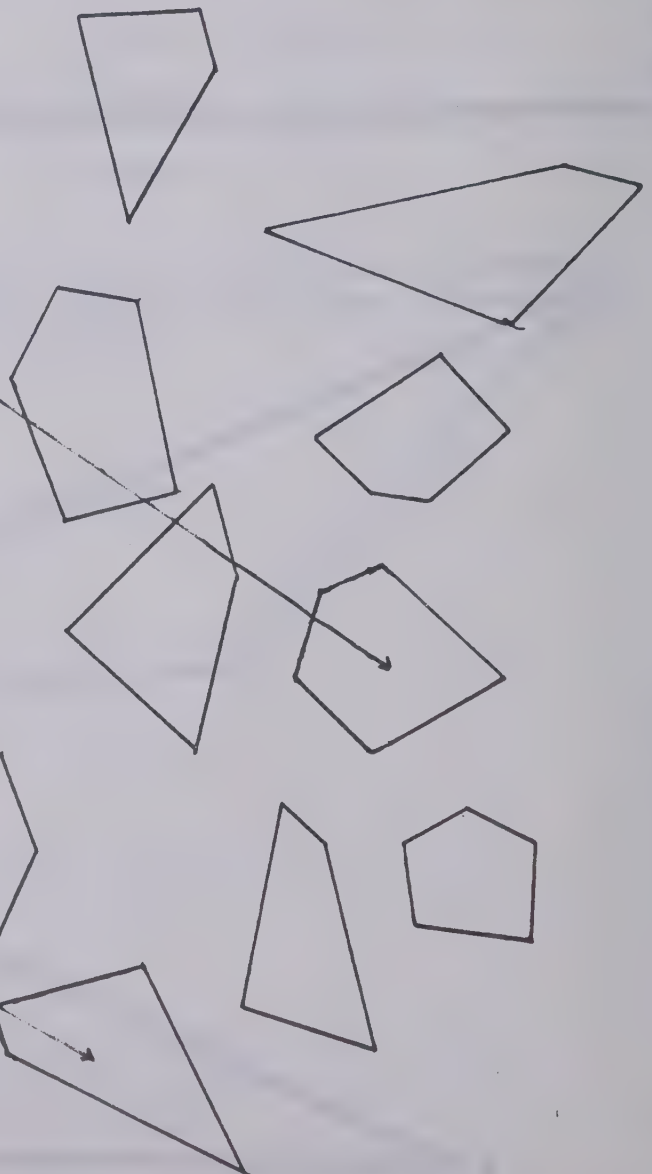
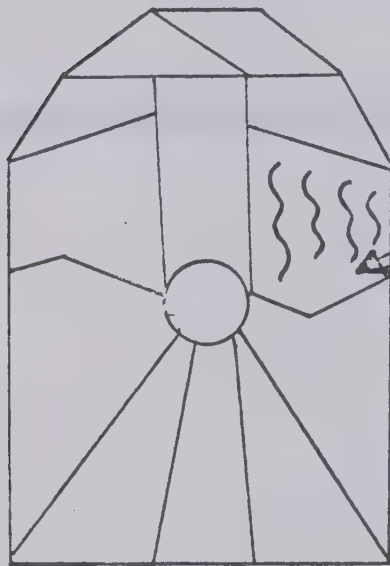
I. Select by tracing the pairs of congruent figures.



*8 and 11
7 and 13
2 and 12*

II. DECORATIVE WINDOWS

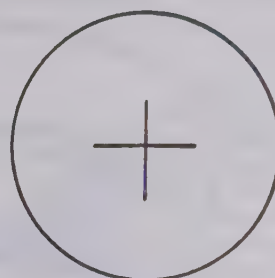
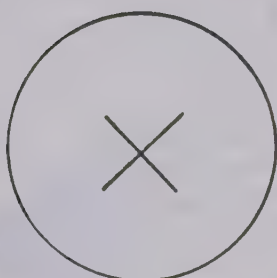
A glass pane is to be replaced in each of the two window frames below. Draw a line joining the pane in the frame and the polygon at the right which would fit it.



COLOR THE WINDOW: Color each polygon region so that no two polygons with the same color touch. Use as few colors as possible.

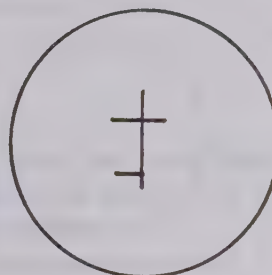
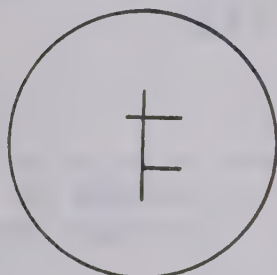
III. Determine whether the following sets of figures are congruent, using the method of tracing.

a)



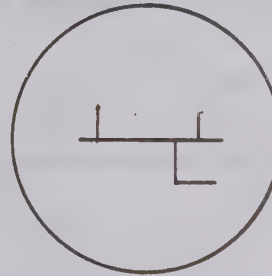
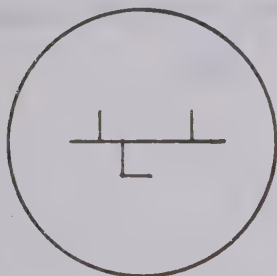
Answer YES

b)



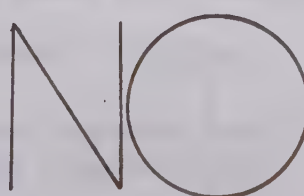
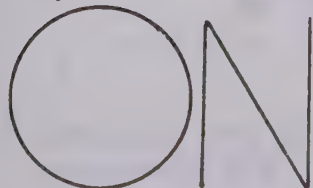
Answer No

c)



Answer No

d)



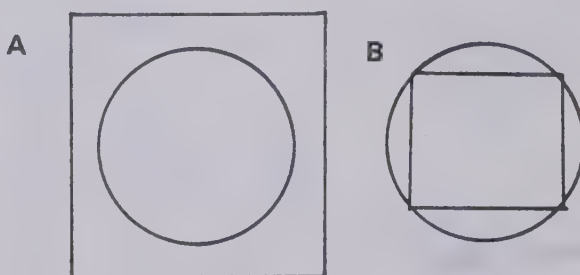
Answer YES

IV. In doing these exercises, be sure to test each of your answers.
You may be surprised.

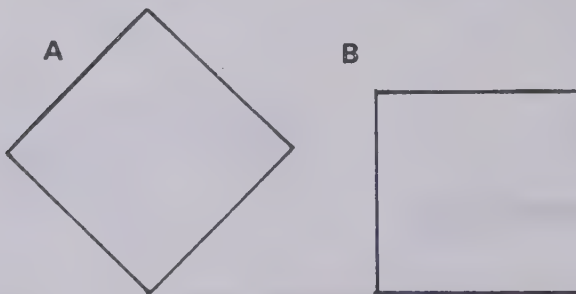
1. Is figure "A" congruent to figure "B"? **YES**



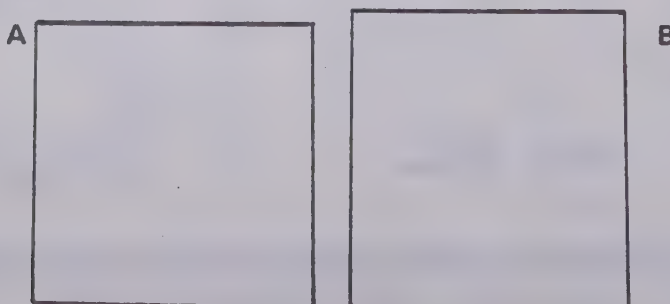
2. Is the circle in figure "A" congruent to the circle in figure "B"? **YES**



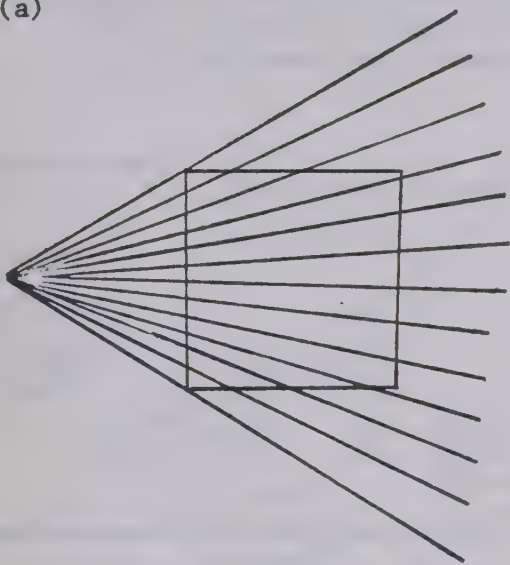
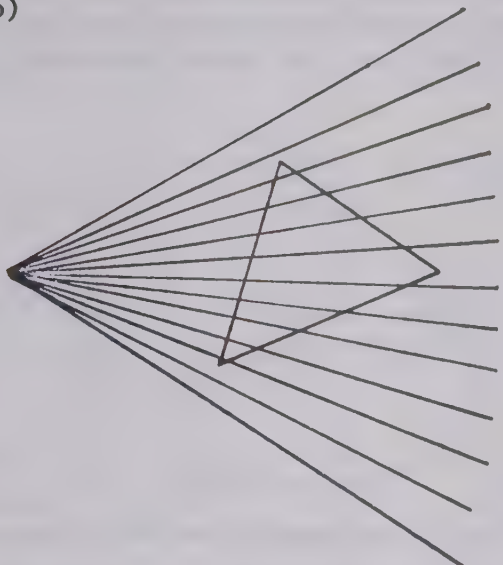
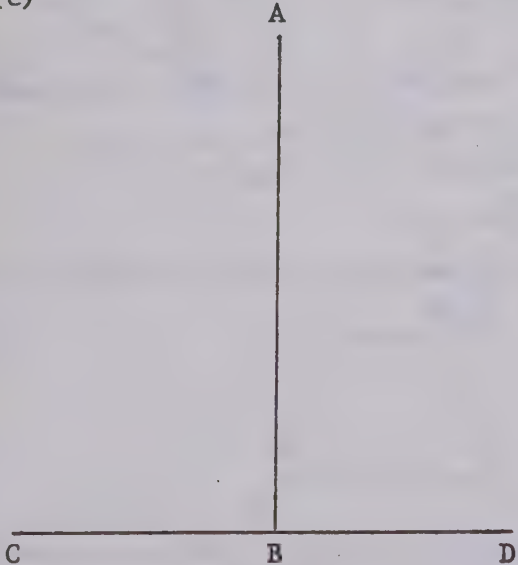
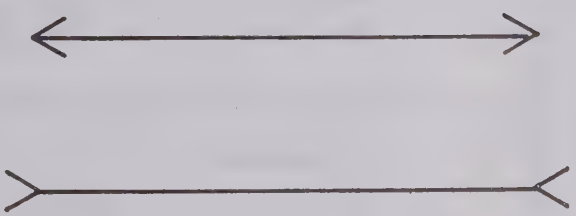
3. Is square "A" congruent to square "B"? If not, which is larger? **YES**



4. A square must have four congruent sides. One of these figures is a square. The other is not. Which is the square? **A**

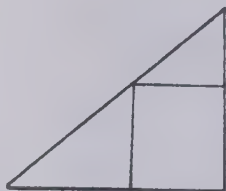


V. Checking for congruence using optical illusions.

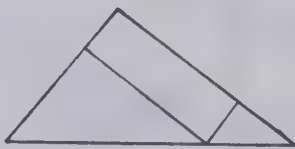
<p>(a)</p>  <p>Is the figure a square? NO Are the sides of the figure congruent? NO</p>	<p>(b)</p>  <p>Is this an equilateral triangle? NO Check to see if the sides are congruent.</p>
<p>(c)</p>  <p>Are these two line segments congruent? YES</p>	<p>(d)</p>  <p>Are these segments parallel? YES Are they congruent? NO</p>

VI. Choose the pairs in each row that are equal in all respects (congruent). Check your choices any way you want. Symbols for congruent are \leftrightarrow , \cong .

1.



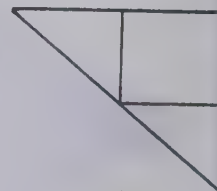
(a)



(b)



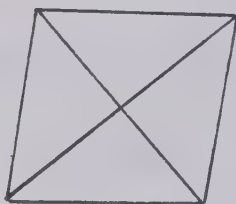
(c)



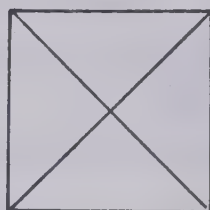
(d)

$$c \cong d$$

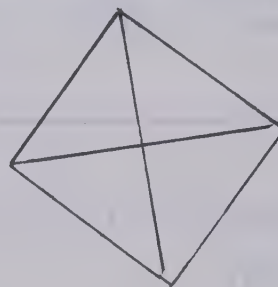
2.



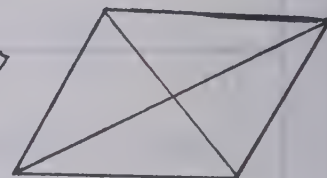
(a)



(b)



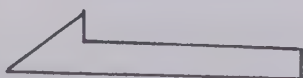
(c)



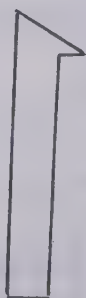
(d)

$$b \cong c$$

3.



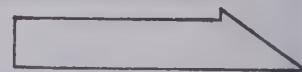
(a)



(b)



(c)

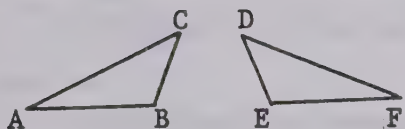


(d)

$$a \cong c$$

- VII. (a) By tracing, check which of the following pairs of polygons are congruent, you may have to flip your tracing paper over.
- (b) Construct a "goes to" table for each pair of congruent figures and name four corresponding congruent parts for each pair.

1. ✓

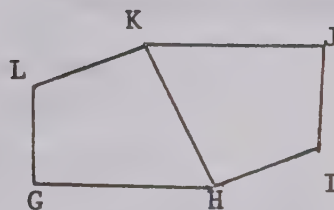


$C \rightarrow D$
 $B \rightarrow E$
 $A \rightarrow F$

$\angle ACB \cong \angle FDE$
 $\angle CAB \cong \angle DFE$
 $\angle CBA \cong \angle DEF$

$\overline{AB} \cong \overline{FE}$
 $\overline{AC} \cong \overline{FD}$
 $\overline{CB} \cong \overline{DE}$

2. ✓

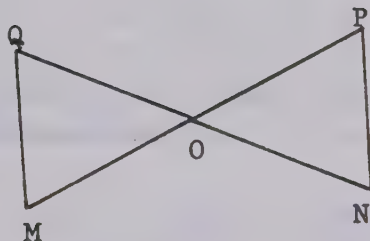


$J \rightarrow G$
 $I \rightarrow L$
 $H \rightarrow K$
 $K \rightarrow H$

$\angle KJI \cong \angle HGL$
 $\angle JIH \cong \angle GLK$
 $\angle JKH \cong \angle GHK$
 $\angle IHK \cong \angle LKH$

$\overline{JI} \cong \overline{GL}$
 $\overline{KJ} \cong \overline{HG}$
 $\overline{IH} \cong \overline{LK}$

3. ✓

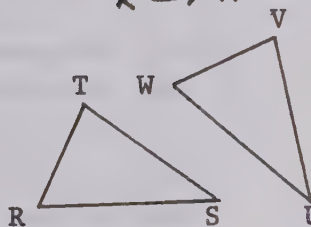


$Q \rightarrow P$
 $M \rightarrow N$
 $O \rightarrow O$

$\angle MQO \cong \angle NPO$
 $\angle QOM \cong \angle PON$
 $\angle OMQ \cong \angle ONP$

$\overline{QO} \cong \overline{PO}$
 $\overline{OM} \cong \overline{ON}$
 $\overline{MQ} \cong \overline{NP}$

4. ✓

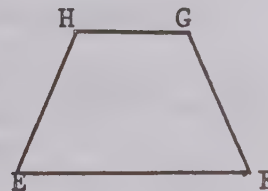
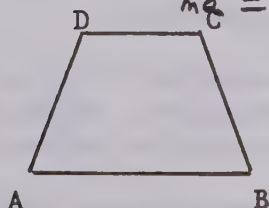


$T \rightarrow V$
 $R \rightarrow W$
 $S \rightarrow U$

$\angle RTS \cong \angle WVU$
 $\angle TSR \cong \angle VUW$
 $\angle SRT \cong \angle UWV$

$\overline{RT} \cong \overline{WV}$
 $\overline{TS} \cong \overline{VU}$
 $\overline{SR} \cong \overline{UW}$

5.



FIGURES ARE NOT CONGRUENT

DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

UNIT: VII

OBJECTIVE NO: 3

OBJECTIVE: Fill in the necessary requirements to complete diagrams for the motion of a slide using correct correspondence notation.

MATERIALS: Acetate sheets, felt pen, overhead with dot transparency, dot paper.

SUGGESTED DEVELOPMENT:

I (1) Draw any polygon and slide arrow, as shown in Diagram One.

(2) Trace $\triangle CAT$ and slide arrow on clear acetate.

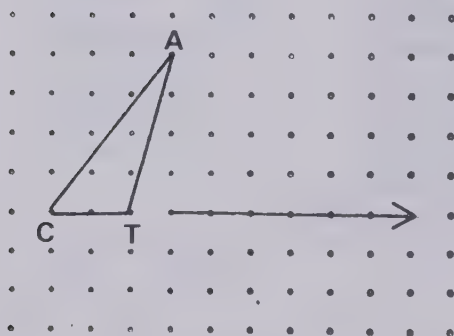


Diagram One

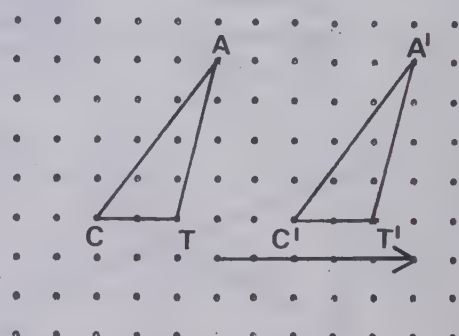


Diagram Two

(3) Slide tracing until tail of traced arrow falls on head of original arrow.

(4) Copy tracing of CAT on to original sheet and label C A T , as shown in Diagram Two.

NOTE: Students can accomplish this by pressing heavily with their pens on the vertices and then connecting the impressions.

(5) Discuss with class the requirements for a slide;
(a) original CAT, (b) slide arrow
(c) image C A T .

NOTE: When you are making your transparencies, enlarge the diagrams as much as possible. This will give you a larger image on the screen.

- II (1) Draw pentagon WENDY and image W E N D Y as in Diagram Three.
- (2) Trace WENDY, slide to fit on W E N D Y and draw slide arrow that describes the slide.
Diagram Four.
- (3) Discuss with students the various locations for the slide arrow. (Location may vary but length and directions are the same.)

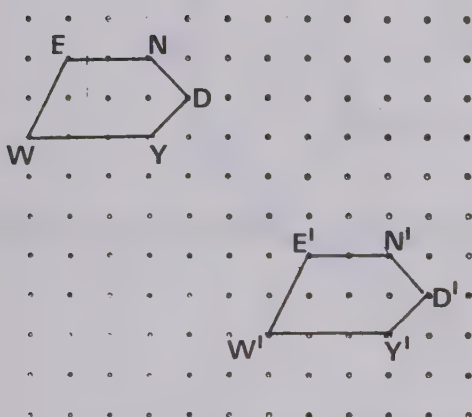


Diagram Three

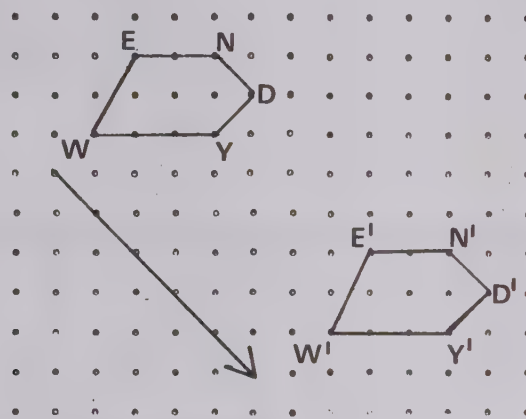


Diagram Four

- III. (1) Draw image of quadrilateral TONY and slide arrow as shown in Diagram Five.
- (2) Trace T O N Y and slide arrow, slide tracing to locate TONY as in Diagram Six.

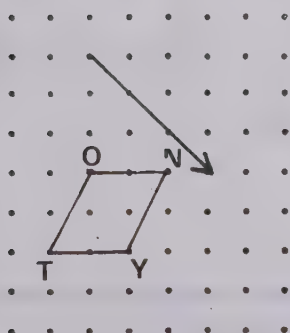


Diagram Five

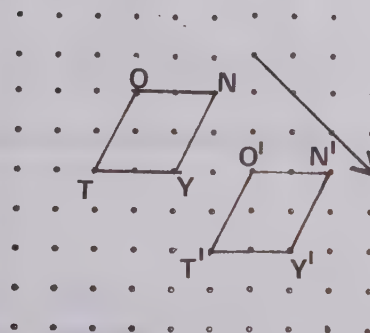
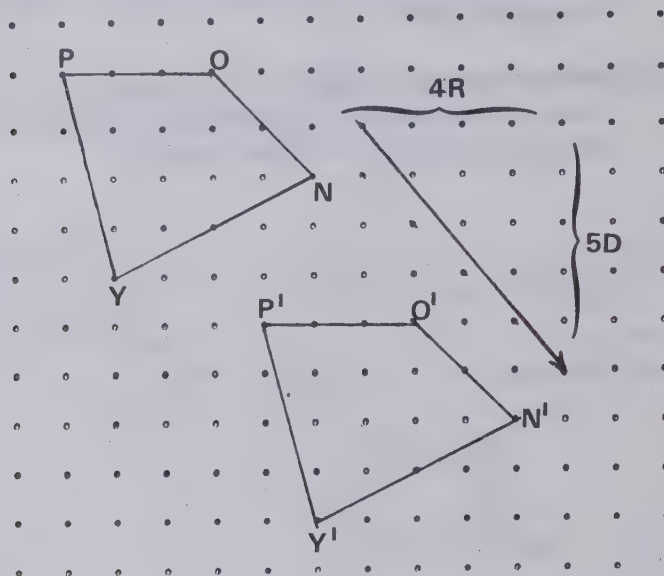


Diagram Six

IV. Use of Slide Notation

- (1) Draw any polygon, a slide arrow, and its image as in the diagram.
- (2) Count horizontally, then vertically, from the tail of the arrow to the head of the arrow, and record.



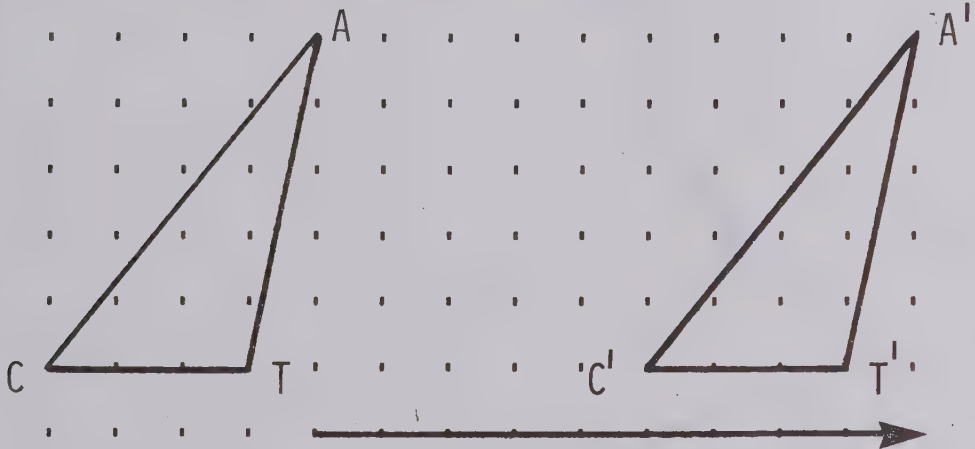
- (3) Check to see if the same count will take you from O to O' from Y to Y' .
- (4) Have the students check other vertices.
- (5) Discuss this method of slide notation,
 - does it describe the slide?
 - is $(4R, 5D)$ an efficient method of notation?
 - use : R for right
 L for left
 D for down
 U for up
 - First component is always horizontal motion.
 Second is the vertical motion.

REQUIREMENTS OF A SLIDE

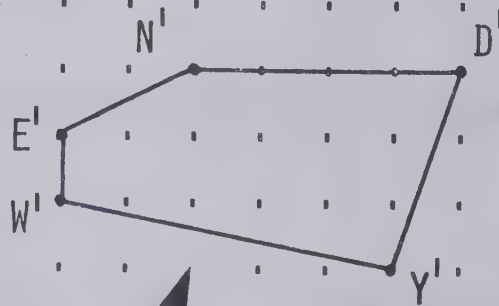
1. ORIGINAL

2. SLIDE ARROW

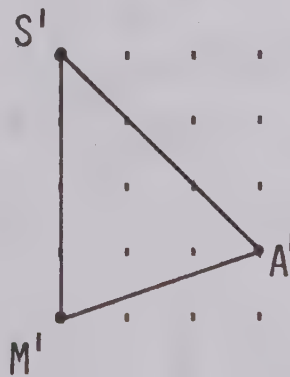
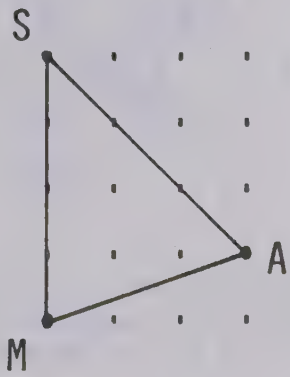
3. IMAGE



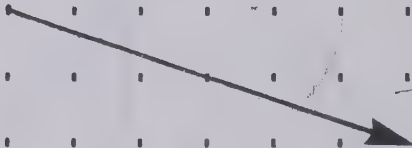
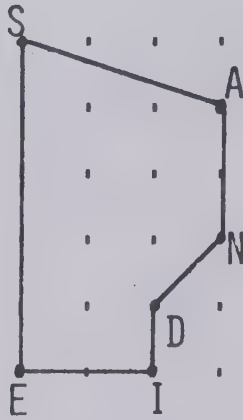
FIND THE ORIGINAL



FIND THE SLIDE ARROW



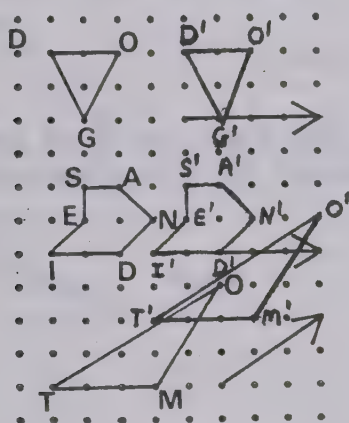
FIND THE IMAGE



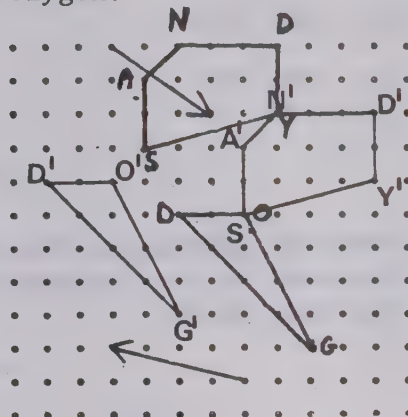
REQUIREMENTS OF A SLIDE

1. Draw each polygon on your dot paper. Draw a slide arrow as shown. Draw the image of each. Label the image correctly.

e.g. DOG and $D'O'G'$

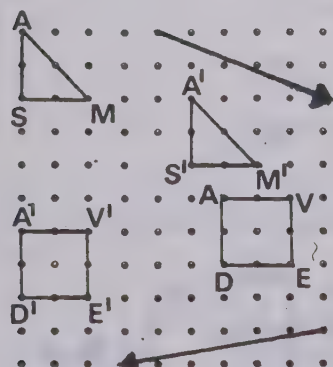


3. Draw each image on your dot paper. Draw the original polygon.



Is the distance that D moved to become D' the same as the distance from O to O' and G to G' ? YES

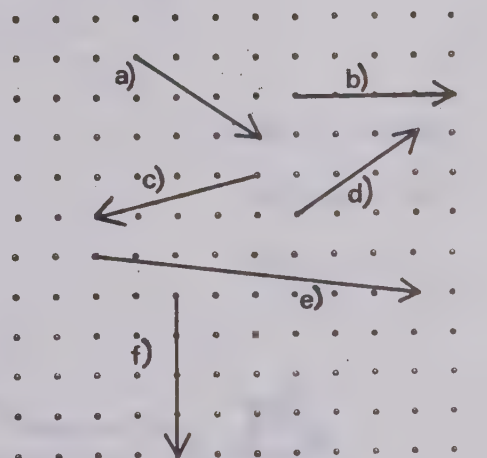
2. Draw each polygon on your dot paper. Draw a slide arrow to indicate the motion.



Can you draw more than one slide arrow to show these slides?

YES

- 4.



Describe each slide arrow above using slide notation. The first is done as an example.

(a) $(3R, 2D)$

(b) $(4R, 0D)$

(c) $(4L, 1D)$

(d) $(3R, 2U)$

(e) $(8R, 1D)$

(f) $(0R, 4D)$

A SLIDE NEEDS

1. An original
2. A slide arrow
3. An image

5. Draw a slide arrow on your dot paper for each of the following:

(a) $(3L, 0)$

(d) $(5L, 2U)$

(b) $(2R, 4U)$

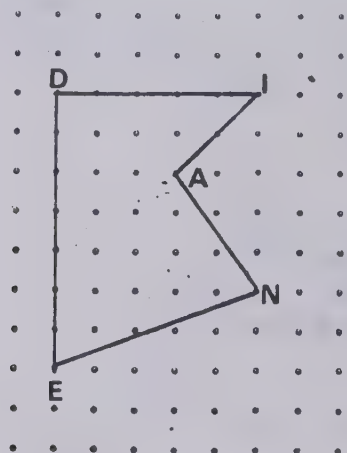
(e) $(0, 2U)$

(c) $(3R, 3D)$

(f) $(2L, 4D)$

see next page

6. Draw the polygon in the diagram on your dot paper and draw image for each of the following. Use the original for the starting point for each slide.



see next page

(a) $(2R, 3D)$

(d) $(5L, 0)$

(b) $(2L, 3U)$

(e) $(1L, 3U)$

(c) $(0, 4D)$

(f) $(2R, 4U)$



1st component horizontal motion

2nd component vertical motion



(a)



(b)



(c)



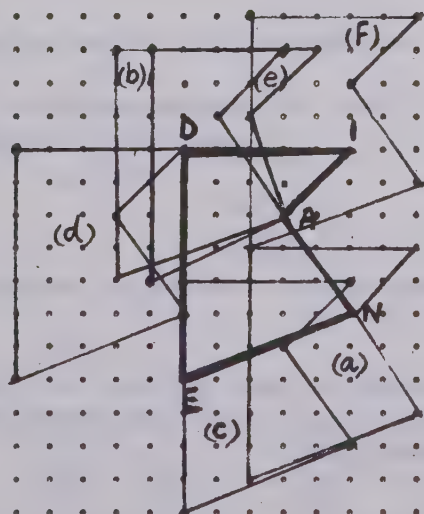
(d)



(e)



(f)



DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

UNIT: VII

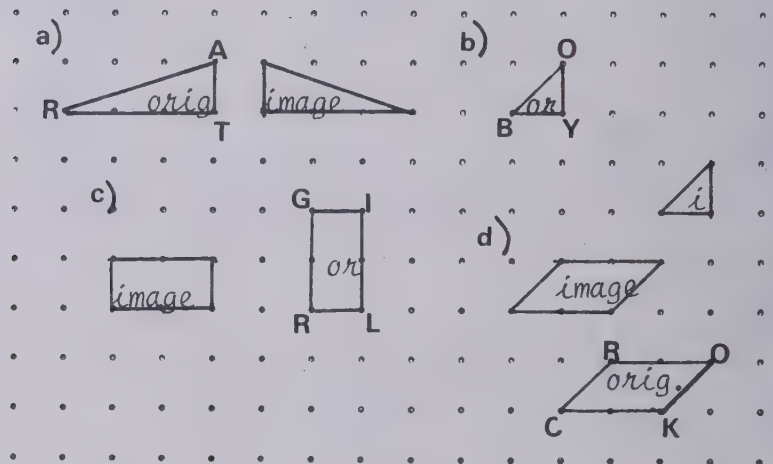
OBJECTIVE NO: 4

OBJECTIVE: Determine whether a pair of congruent polygons were produced by a slide.

MATERIALS:

Overhead, transparencies, acetate, dot paper.

SUGGESTED DEVELOPMENT: 1. Present the students with the following diagram. If you use the overhead, trace the originals on the acetate, then try sliding the tracing to fit the image. Point out that a slide does not turn or flip the image.



2. Label the images using prime notation.

3. Make a "Goes To" table for (b)

$B \longrightarrow B'$

$O \longrightarrow O'$

$Y \longrightarrow Y'$

and name the corresponding congruent sides and angles.

4. Have students make a "Goes To" table for example (c) and list the corresponding congruent parts.

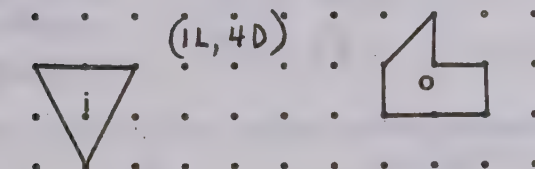
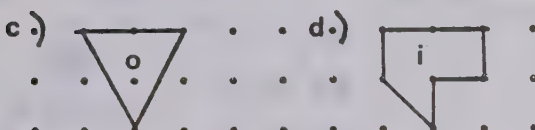
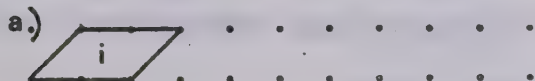
EXERCISES:

OBJECTIVE NO. 4

1. Answer the following questions, using the diagrams below.

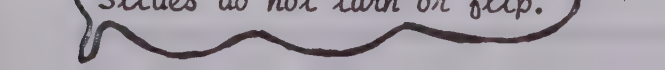
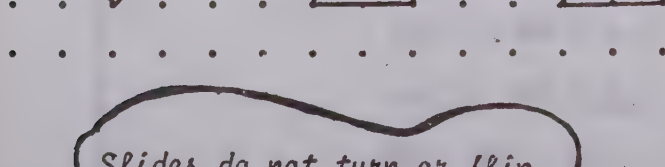
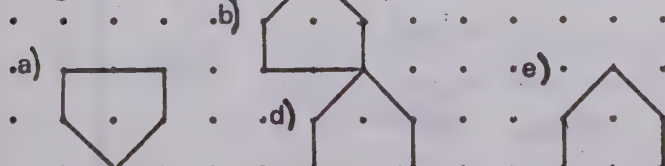
(i- indicates the image)

- (i) Which images were produced by a slide? *b, c*
- (ii) Give the slide notations for the two slides in (i).

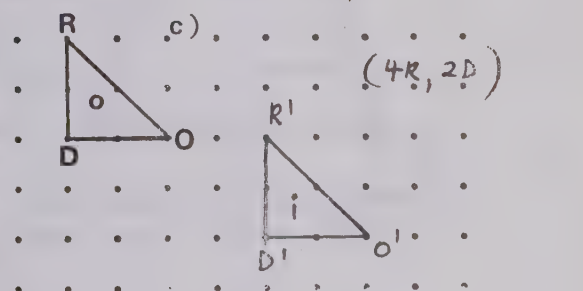
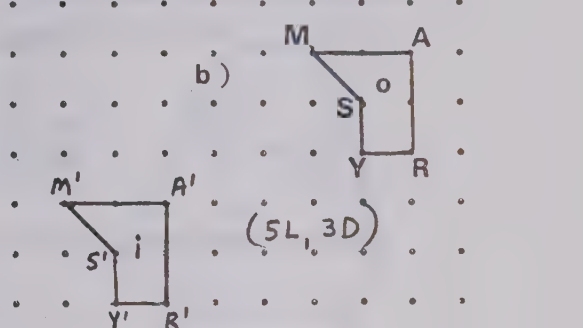
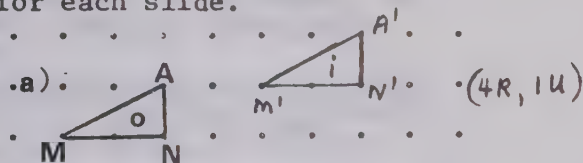


2. Which of the following are slide images of polygon 'SPACE'?

b, d, e



3. For each of the following, determine if the given segment or segments, are the slide image of one of the sides of the polygon. Draw the diagram on your dot paper and complete the image. Give the slide notation for each slide.



4. The following statements are either true or false.

- a. If a figure has a vertex A in the top right corner, then the slide image will have A' in the top right corner. *true*
- b. A slide image is at an angle to the original of 90°. *false*
- c. If APES are the vertices of a square going clockwise about the figure, then A'S'E'P' are the vertices of the slide image going clockwise. *false*
- d. A slide image can be formed by sliding the original right or left, up or down, or sideways, but no turning or flipping is allowed. *true*

Slides do not turn or flip.

5. From the following diagrams:

- a. Choose the figures congruent to DAVE.

JONH, LUCY

- b. Construct a "Goes To" table for DAVE and each of the congruent figures.

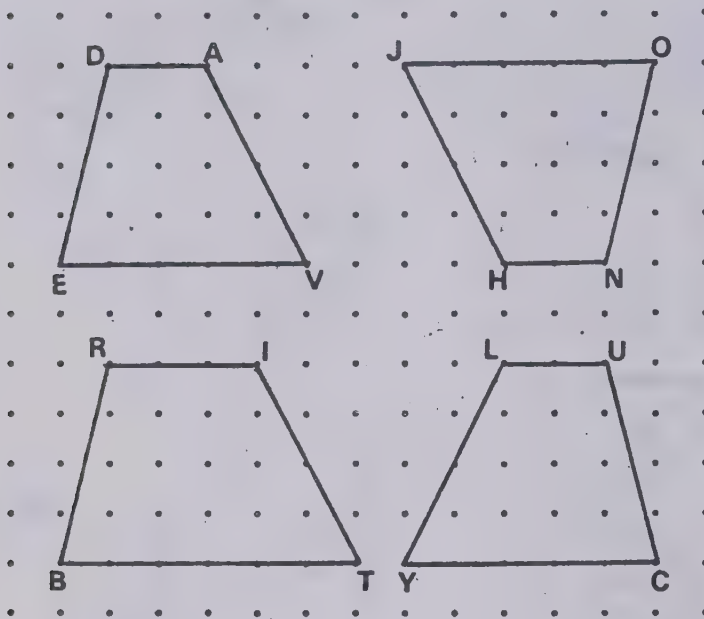
$D \rightarrow N$
 $A \rightarrow H$

$V \rightarrow J$
 $E \rightarrow O$

$D \rightarrow U$
 $A \rightarrow L$

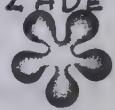
$V \rightarrow Y$
 $E \rightarrow C$

- c. List all the corresponding congruent parts from each "Goes To" table.



$\overline{DA} \cong \overline{NH}$
 $\overline{DE} \cong \overline{NO}$
 $\overline{EV} \cong \overline{OJ}$
 $\overline{VA} \cong \overline{JH}$

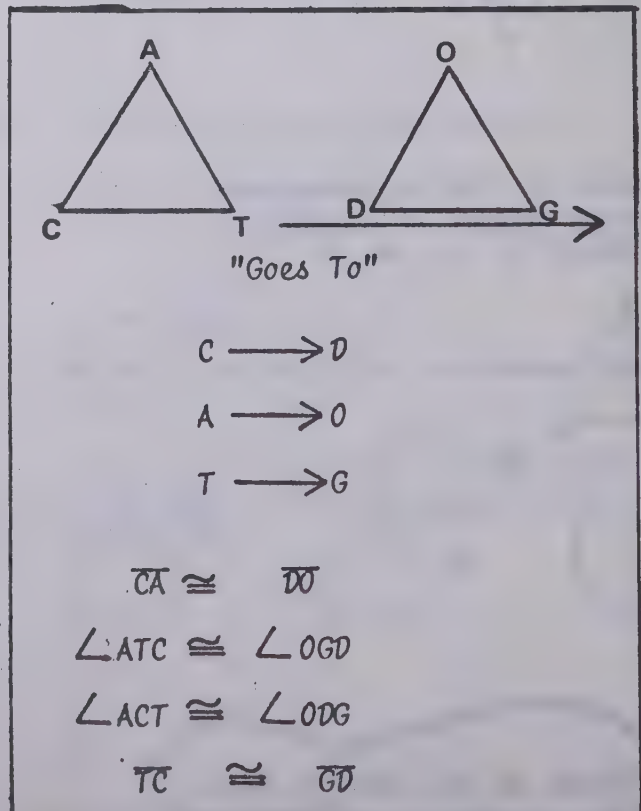
$\angle DEV \cong \angle NOJ$
 $\angle EVA \cong \angle OJH$
 $\angle VAD \cong \angle JHN$
 $\angle ADE \cong \angle HNO$



$\overline{AD} \cong \overline{LU}$
 $\overline{AV} \cong \overline{LY}$
 $\overline{VE} \cong \overline{YC}$
 $\overline{ED} \cong \overline{CU}$



$\angle DAV \cong \angle ULY$
 $\angle AVE \cong \angle LYC$
 $\angle VED \cong \angle YCU$
 $\angle EDA \cong \angle CUL$



DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

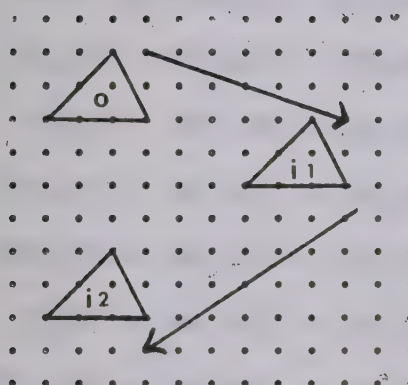
UNIT: VII

OBJECTIVE NO: 5

OBJECTIVE: *Determine one slide that is equivalent to a combination of two slides.

MATERIALS: Overhead, transparencies, acetate, dot paper.

SUGGESTED DEVELOPMENT: 1. Present students with the following diagram. Check image 2, could it have been produced by a slide directly from the original? On the overhead, present three more combinations of slides, then fill in the table.



SLIDE ONE
NOTATION

SLIDE TWO
NOTATION

SHORT-CUT
NOTATION

1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____

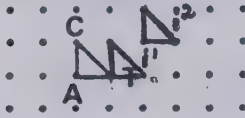

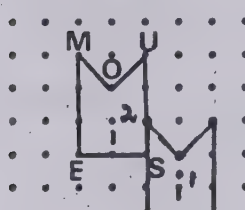
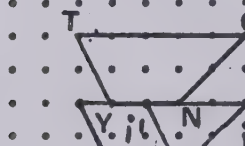
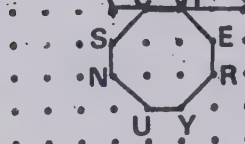
2. After filling out the table, students should realize or have pointed out to them, that slides can be added.
e.g. $(6R, 2D) + (6L, 4D) \sim (0, 6D)$
3. With a high ability class you may wish to:
 - a) discuss the commutative and transitive properties of a slide;
 - b) Opposite slides of the same magnitude are inverses.
 - c) relate slides to vectors.

NOTE: Difficulties encountered with the properties of the number systems may be cleared up by using the motions as a model.

EXERCISES:

OBJECTIVE NO. 5

1. Copy the following on to your dot paper and obtain the indicated slide images. Always use image one to obtain image two.

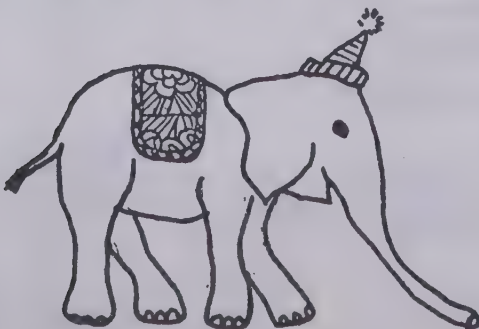
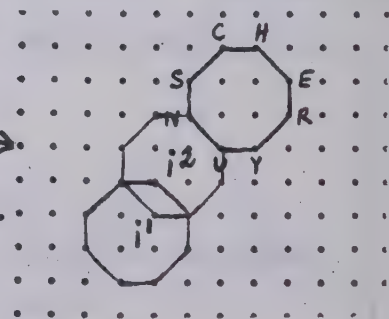
- (a)  Slide One (1R, 0)
Slide Two (1R, 1U)
- (b)  Slide One (1R, 1D)
Slide Two (2L, 0)
(1L, 1D)
- (c)  Slide One (2R, 2D)
Slide Two (2L, 2U)
(0, 0)
- (d)  Slide One (0, 2D)
Slide Two (2R, 0)
(2R, 2D)
- (e)  Slide One (3L, 4D)
Slide Two (1R, 2U)
(2L, 2D)

2. Each of the combinations in #1 can be described as a single slide. Use slide notation to name each of the single slides. The first is done as an example.

- (a) $(1R, 0) + (1R, 1U) \sim (2R, 1U)$

3. Write a single slide that would produce the same results as:

- (a) $(2R, 4U)$ followed by $(1R, 1U) \sim (3R, 5U)$
(b) $(3R, 1U)$ followed by $(1L, 2D) \sim (2R, 1D)$
(c) $(2L, 1D)$ followed by $(4L, 4U) \sim (6L, 5U)$
(d) $(1L, 2D)$ followed by $(2R, 5U) \sim (3R, 7U)$
(e) $(3L, 3D)$ followed by $(3R, 3U) \sim (6L, 6U)$
(f) $(2R, 3D)$ followed by $((4L, 1U) \sim (6L, 2U))$
4. Determine the missing slide.
- (a) $(2L, 2D) + (4R, 3U) \sim (2R, 1U)$
(b) $(5R, 2U) + (5L, 4D) \sim (0, 2D)$
(c) $(1R, 3U) + (3R, 2U) \sim (4R, 5U)$
(d) $(6R, 4D) + (8L, 7U) \sim (2L, 3U)$
(e) $(3L, 4D) + (5R, 4U) \sim (2R, 0)$
(f) $(0, 3U) + (2R, 2D) \sim (2R, 1U)$



SLIDES
CAN BE
ADDED

STRAND: GeometryLEVEL: 7UNIT: VIIOBJECTIVE NUMBER: 6 & 7OBJECTIVE: 6. Determine the reflection (flip) image for any polygon when provided with the mirror line.7. Determine the mirror line for a polygon and its mirror image.

MATERIALS: Clear acetate, plexiglass mirror, dot paper.

SUGGESTED DEVELOPMENT: I. Finding Reflected Images

1. Use a transparency of a polygon and its mirror image as in Diagram One.

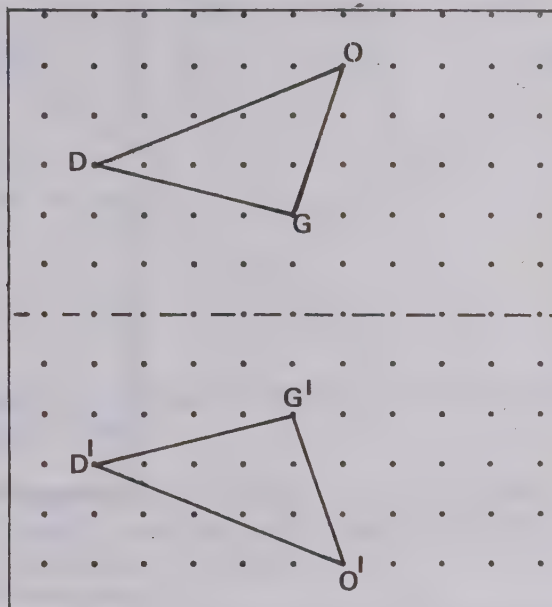


DIAGRAM ONE

2. Demonstrate to students that $\triangle DOG$ and $\triangle D'O'G'$ are congruent, but cannot be formed by a slide (use tracing).
3. Show students that points D and D', O and O', G and G' are equal distance from the mirror line.
4. Have students copy the diagram on their dot paper and fold along the mirror line to see that a mirror image may be formed by paper folding.
5. Have students copy Diagram Two onto their dot paper.
6. Give students the following directions to have them find the mirror image.
 - a) Place mirror on mirror line to form a 90° angle with dot paper.
 - (b) Look from the same side as the original and you will see the reflection.

- c) Use your pen to locate the images of the vertices on the dot paper behind the mirror.
- d) Join the vertices and label (as in Diagram Three).
- e) Check for congruence and location by folding paper along mirror line.

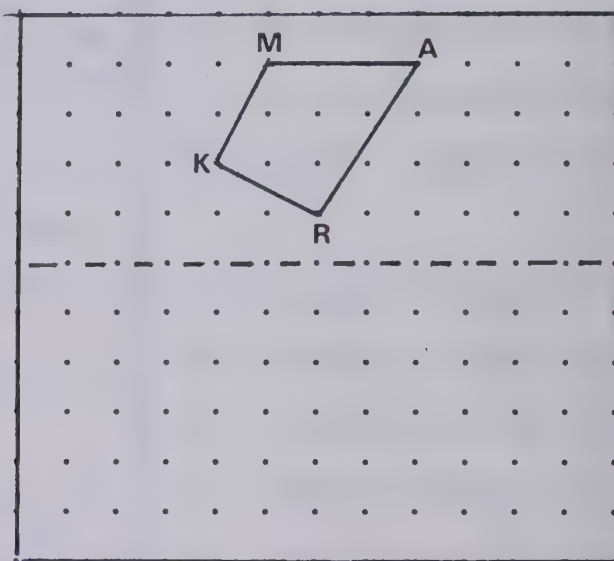


Diagram Two

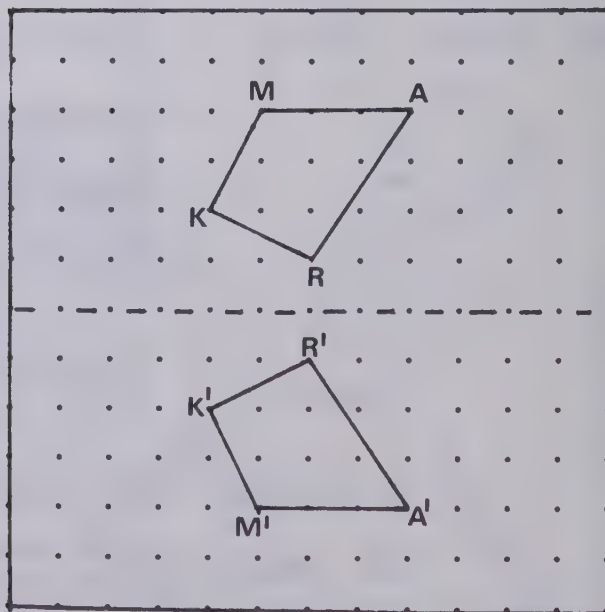
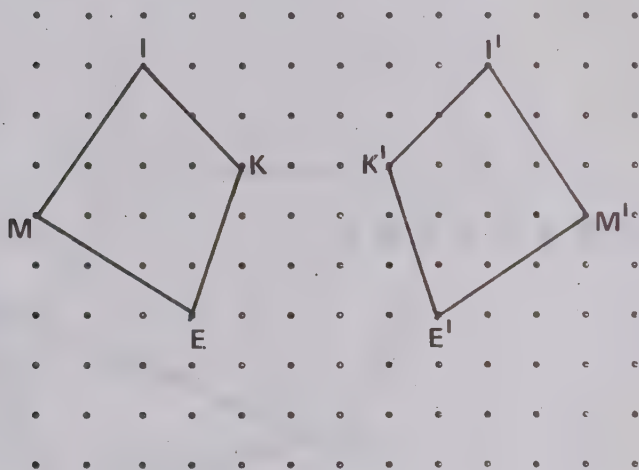


Diagram Three

7. a) Present students with a polygon on dot paper.
- b) Fold a mirror line.
- c) While paper is still folded, press heavily at each vertex of the original polygon.

II Finding the Mirror Line

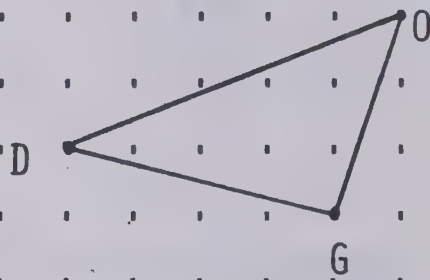
1. Prepare a transparency of a polygon and its image as shown in the diagram.



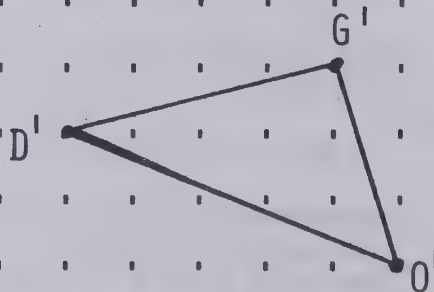
2. Demonstrate manipulation of mirror to locate mirror line.
 - look through mirror from original side until vertices of original fall on vertices of image.
3. Prepare dot paper diagram of polygon and its image as in the diagram.
4. Fold dot paper so that vertices of image fall on vertices of original.
 - fold is mirror line.
5. Prepare transparency of other examples and have students locate mirror line by both methods once they have placed the original and image on their dot paper.

REFLECTIONS

ORIGINAL

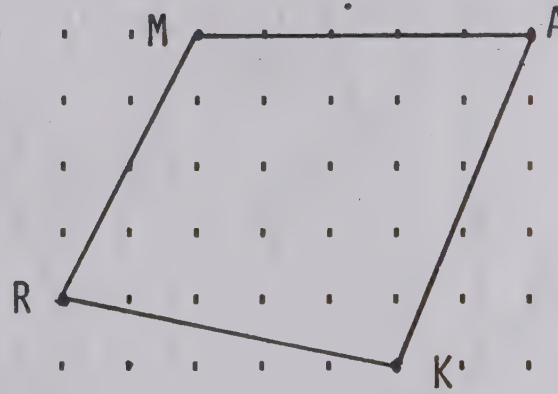


MIRROR LINE

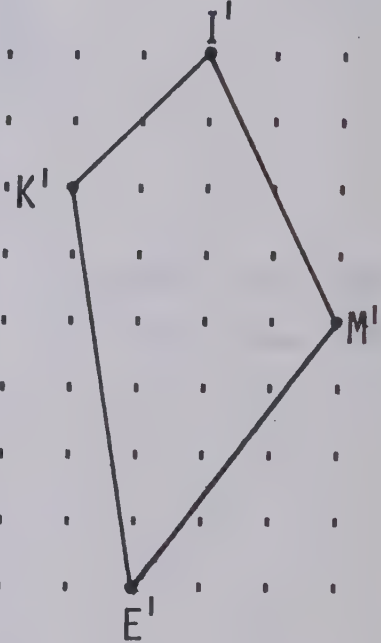


IMAGE

TO FIND THE REFLECTION



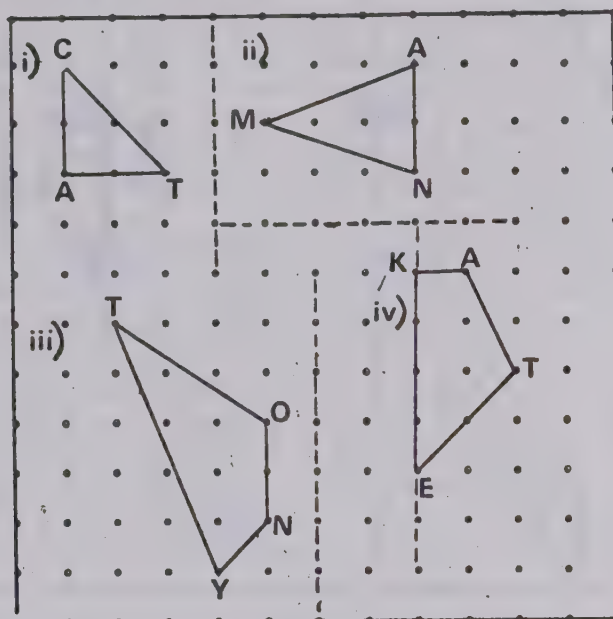
TO FIND THE MIRROR LINE



EXERCISES:

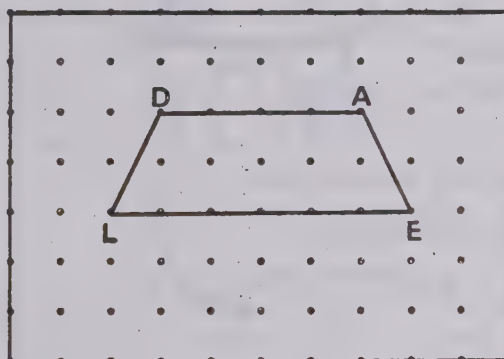
OBJECTIVE NOS. 6 & 7

1. Draw each of the following polygons and mirror lines on your dot paper and draw the images.



2. Find four mirror images of polygon DALE. Use each of the sides as a mirror line.

NOTE: Only reflect the original.



3. What letters of the alphabet and numerals look the same under a reflection in a horizontal line?

CAPITALS: D E H I O X

LOWER CASE: l o x

NUMERALS: 0 1 (8)



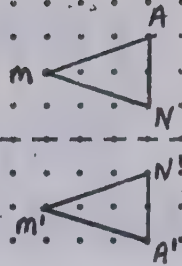
WHEN A POLYGON IS REFLECTED:

- (i) the original and its image are \cong .
- (ii) the corresponding vertices of a polygon and its image are equi-distant from the mirror line.

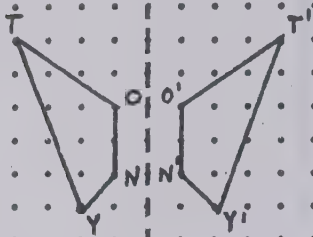
(i)



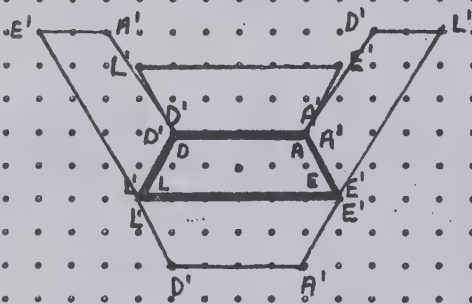
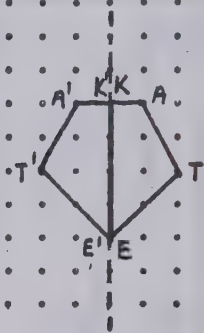
(ii)



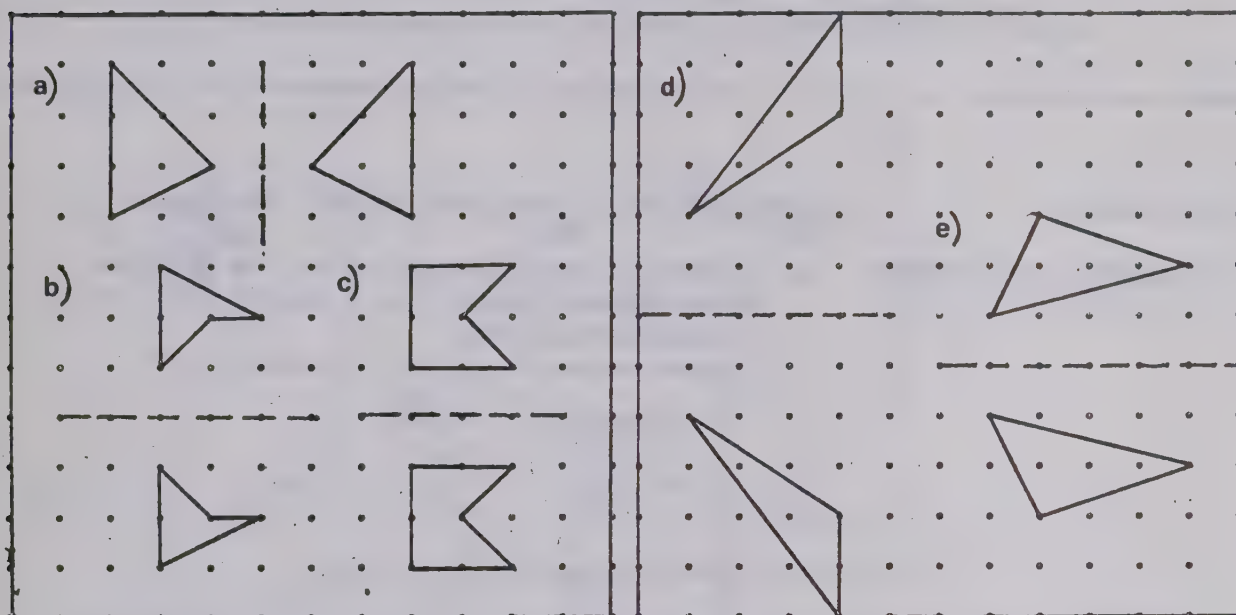
(iii)



(iv)

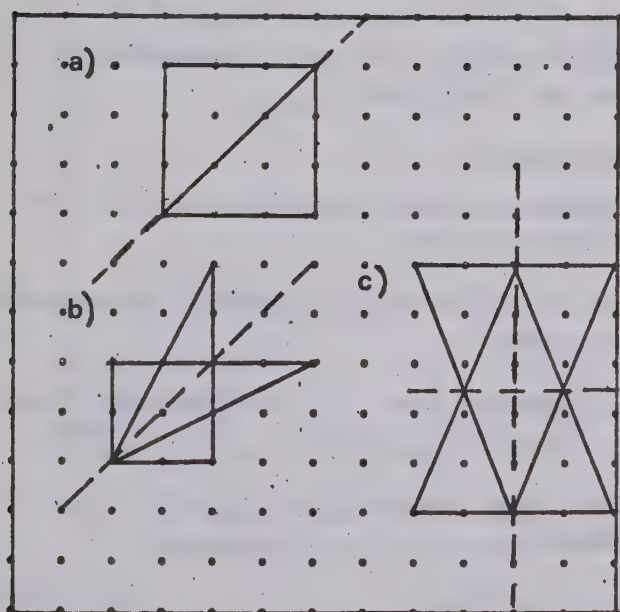


4. In each of the following, copy the polygon and its image on your dot paper. Find and draw the mirror line by manipulating your mirror.



5. Repeat #4 by folding your paper so that the image falls on the original. What is the mirror line for each?

6. Find the mirror lines in these pictures. (Use either method).

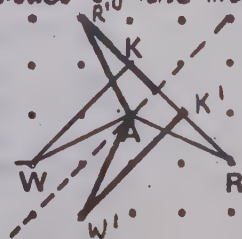
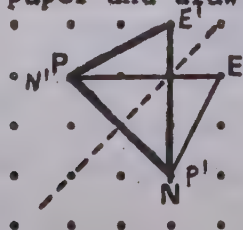


A MIRROR LINE MAY BE FOUND BY:

- (a) paper folding, and
(b) manipulating the mirror
(c) counting



- *7. Place each of the following polygons and mirror lines on your dot paper and draw the images. (Hint: look in both sides of the mirror).



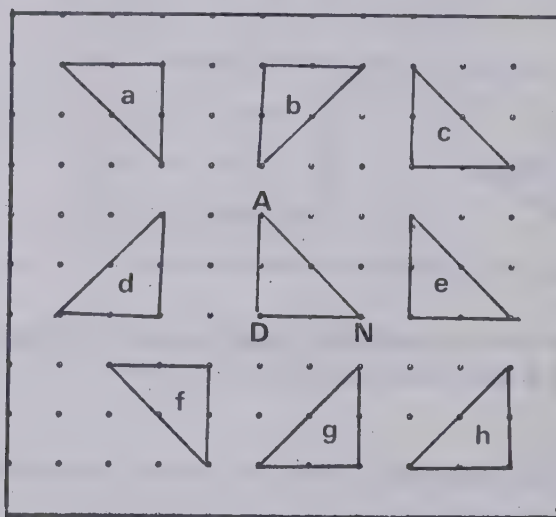
STRAND: GeometryLEVEL: 7UNIT: VIIOBJECTIVE NO: 8

OBJECTIVE: Determine whether a pair of congruent figures were produced by a reflection.

MATERIALS:

Clear acetate, plexiglass mirror, dot paper.

SUGGESTED DEVELOPMENT: 1. Prepare a transparency as in the diagram shown below, containing a number of \triangle 's congruent to \triangle DAN.

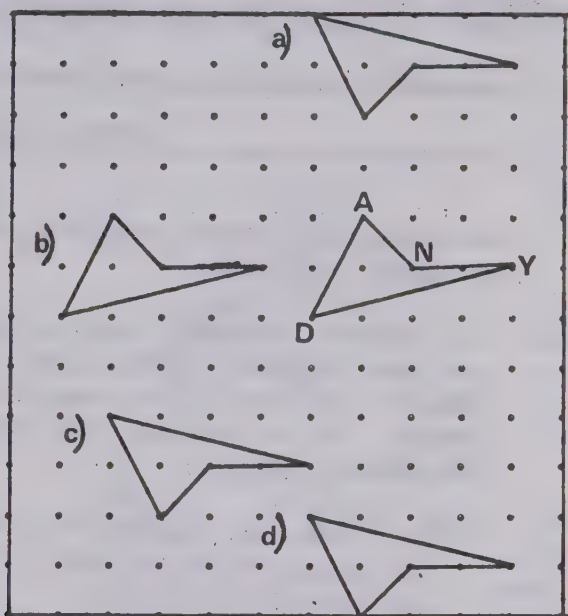


2. Review with students the requirements of a reflection or flip image:
 - (a) congruence,
 - (b) corresponding vertices equidistant from the mirror line.
3. Review the "Goes To" table and the corresponding congruent parts.
4. Have the students draw \triangle DAN and each image on dot paper and try to find a mirror line.
5. Demonstrate that images (b), (d), and (f) are mirror images.

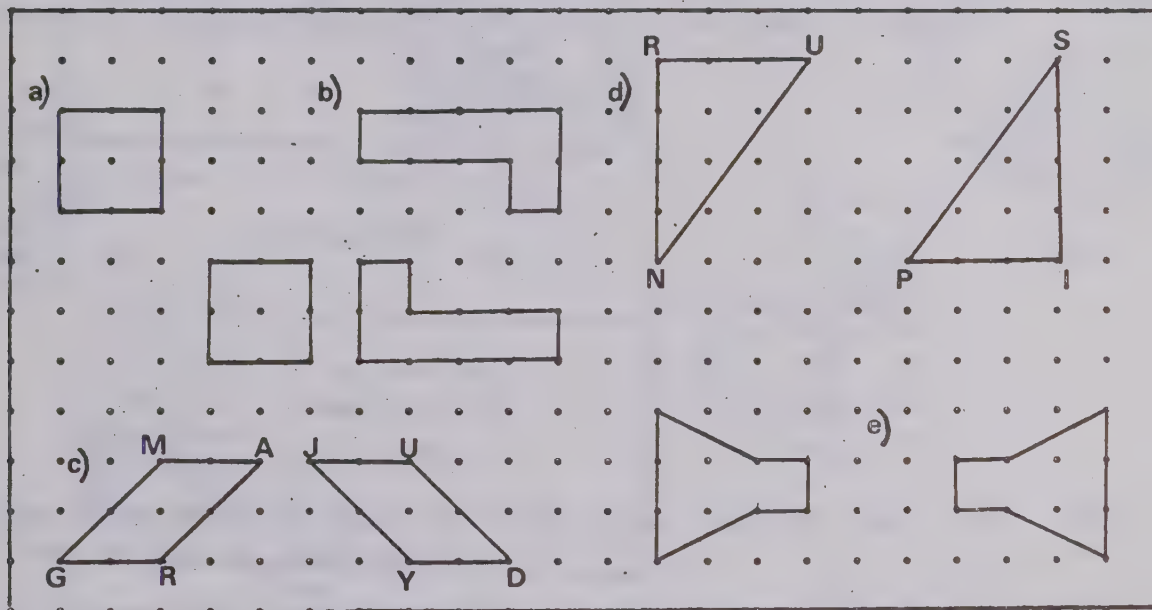
EXERCISES:

OBJECTIVE NO. 8

1. In the following, all polygons are congruent to polygon DANY. Which of them are reflection images of it? (a), (d)



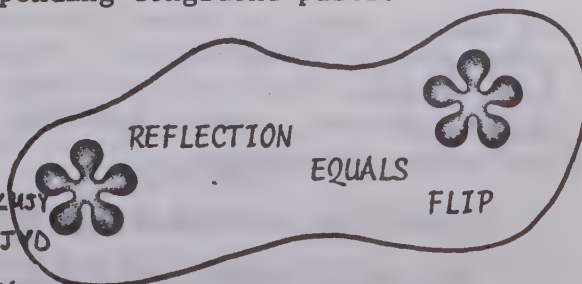
2. (a) Indicate which of the following congruent figures were produced by a reflection or flip. (a), (c), (e)



- (b) Set up a "Goes To" table for (c) and (d) above and list all the corresponding congruent parts.

(c) $M \rightarrow U$
 $A \rightarrow J$
 $R \rightarrow Y$
 $G \rightarrow D$

$\overline{AM} \cong \overline{JU}$ $\angle MAR \cong \angle UJY$
 $\overline{RG} \cong \overline{YD}$ $\angle ARG \cong \angle JYD$
 $\overline{MG} \cong \overline{UD}$ $\angle RGM \cong \angle YDU$
 $\overline{AR} \cong \overline{JY}$ $\angle GMA \cong \angle DUJ$



(d)

$N \rightarrow S$
 $R \rightarrow I$
 $U \rightarrow P$

$\overline{NR} \cong \overline{SI}$
 $\overline{RU} \cong \overline{IP}$
 $\overline{UN} \cong \overline{PS}$

$\angle UNR \cong \angle PSI$
 $\angle NRU \cong \angle SIP$
 $\angle RUN \cong \angle IPS$

DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

UNIT: VII

OBJECTIVE NO: 9

OBJECTIVE: *Determine the image after a combination of two reflections.

MATERIALS: Overhead, dot transparencies, dot paper, mirrors.

SUGGESTED DEVELOPMENT: 1. Present students with a polygon (Diagram One) and two parallel mirror lines. Find the first image. Use the first image to obtain the second image. Do not reflect the original to obtain the second image.

NOTE: This can be done very nicely on the overhead using solid polygons and flipping them about the mirror lines.

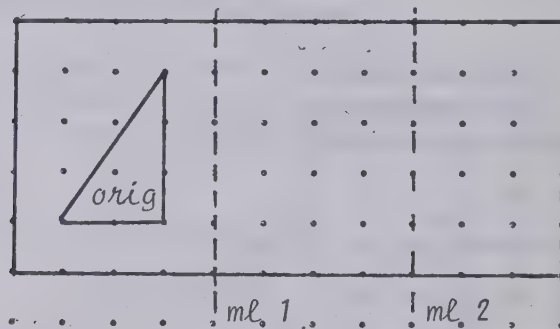


DIAGRAM ONE

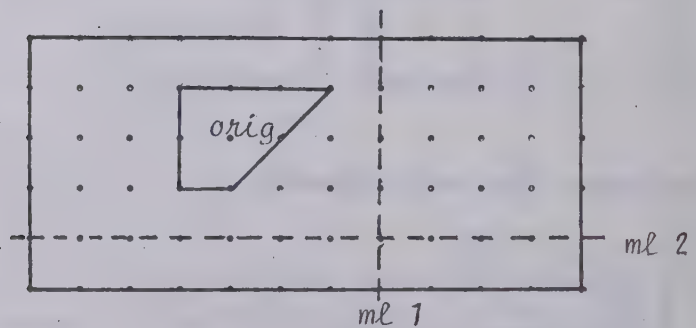


DIAGRAM TWO

2. Repeat above procedure for mirror lines that are perpendicular (Diagram Two). Point out that only with parallel lines does the image return to its normal position. Check to see if the order of reflection matters.

3. With a high ability class, you may wish to:

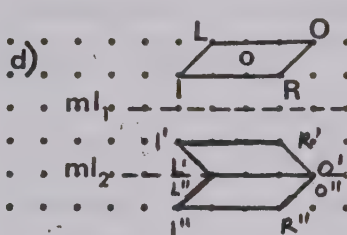
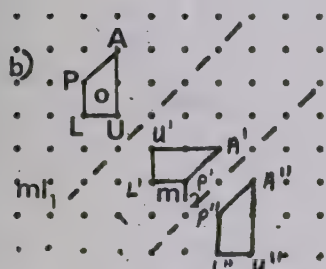
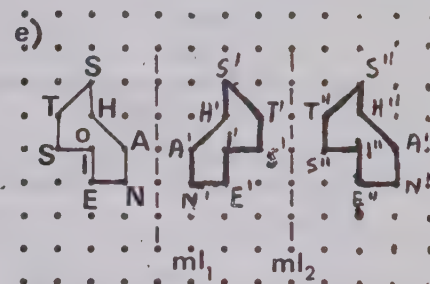
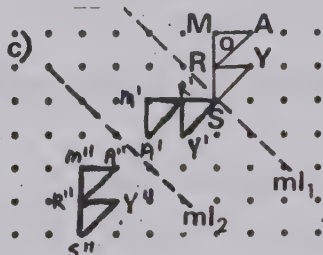
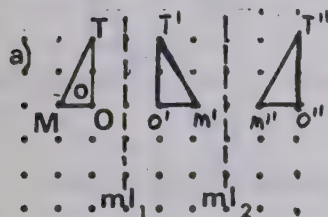
- (a) vary the angle of the two reflection lines;
- (b) check out the various number system properties

Successive Reflections

EXERCISES:

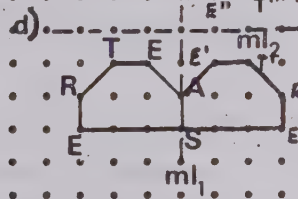
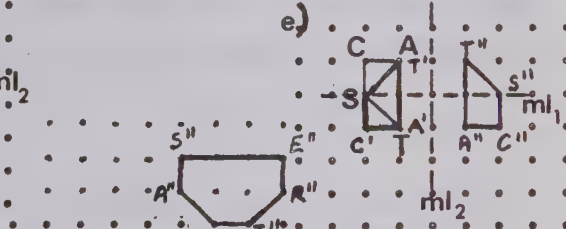
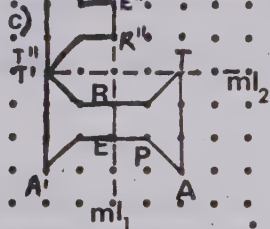
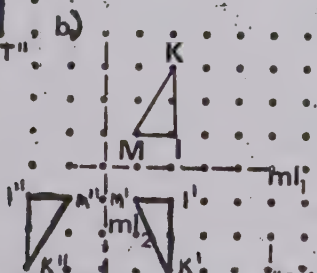
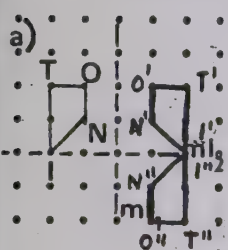
OBJECTIVE NO. 9

1. Copy the following on to your dot paper. Reflect original in ml_1 (mirror line). Draw image. Reflect image in ml_2 . Draw second image. Label all images.



f) What one motion would produce the same result as reflecting into two parallel lines? *a slide*

2. In this exercise, your mirror lines are not parallel but perpendicular. Find the image after both reflections. Use your dot paper.



3. (a) Copy exercise #2(a) and #2(b) on to your dot paper again. This time reflect ml_2 then ml_1 .

(b) Does your final image for exercise #2 look different from your final image in exercise #3? *NO*

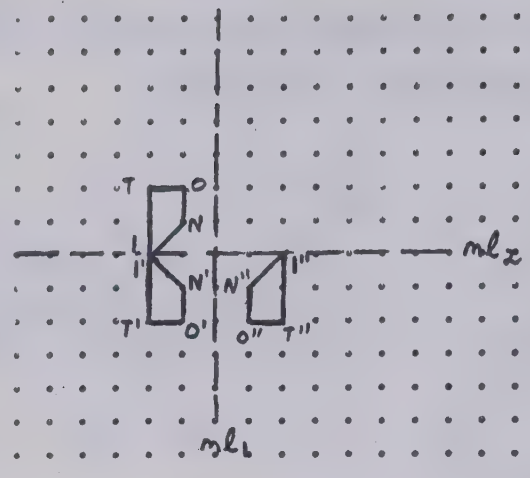
REMEMBER:

Always draw image one first,
then reflect ONLY image one.

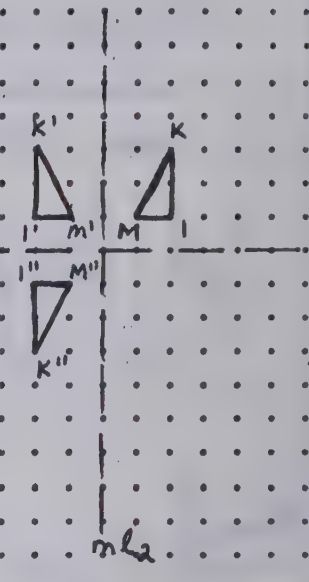


3.

(a)



(b)



STRAND: GeometryLEVEL: 7UNIT: VIIOBJECTIVE NO: 10OBJECTIVE: Obtain all mirror symmetries for various polygons

MATERIALS:

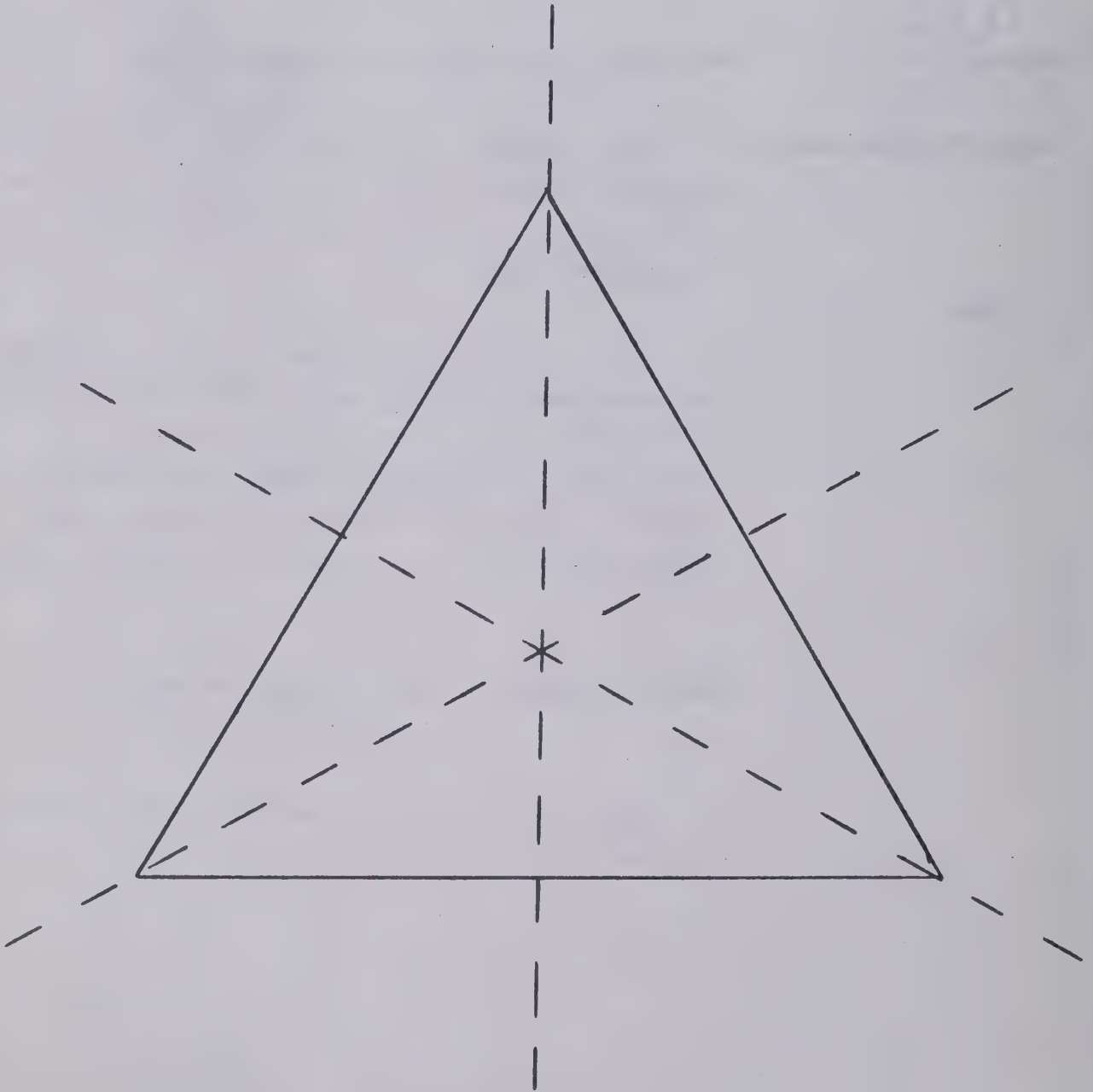
Dot paper, mirrors, scissors, plain paper.

- SUGGESTED DEVELOPMENT:
1. Have students fold a sheet of paper in half and cut out any design they wish. Unfold and place the mirror along the crease. Dot the mirror line and discuss findings.
 2. Pass out a sheet with a large square, rectangle, and equilateral triangle on it. Have the class cut out the three polygons. Fold the polygons to obtain lines of symmetry and then place mirrors on crease and check the reflection. Dot the crease. Discuss how many lines of symmetry each figure has.

LINES OF SYMMETRY: A mirror line that reflects a shape onto itself.

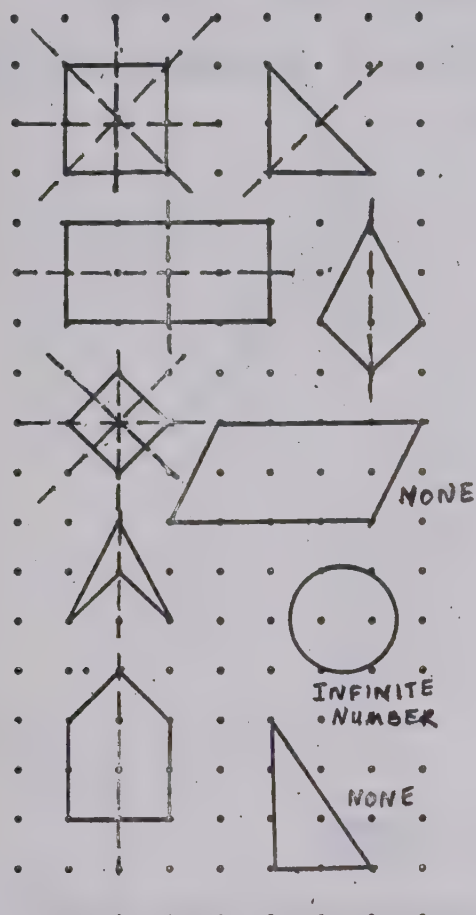
3. Check out the ten digits and the letters of the alphabet for lines of symmetry.
4. Discuss symmetry in nature.

LINES OF SYMMETRY

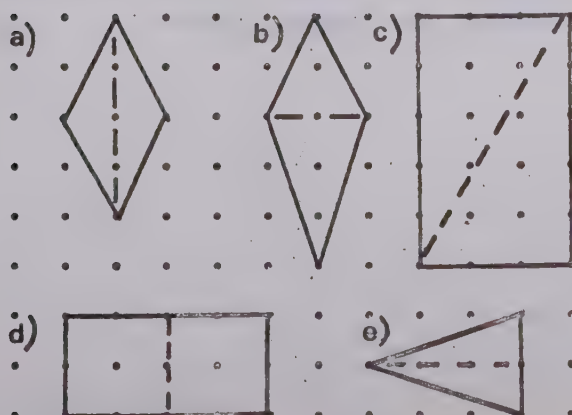


Lines of Symmetry

1. Copy the following onto your dot paper and draw all the lines of symmetry for each.

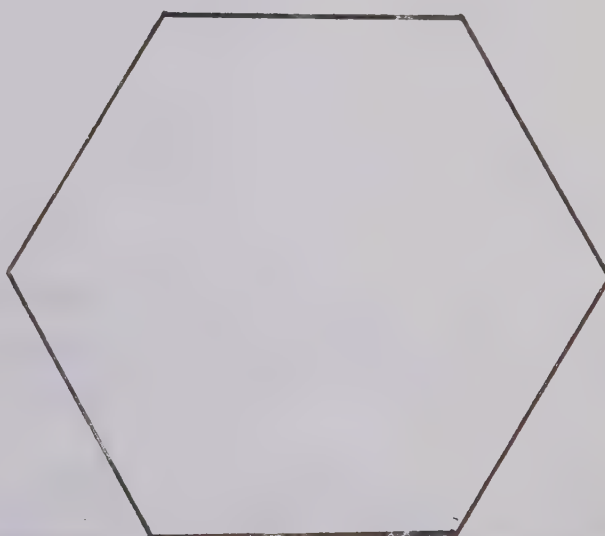
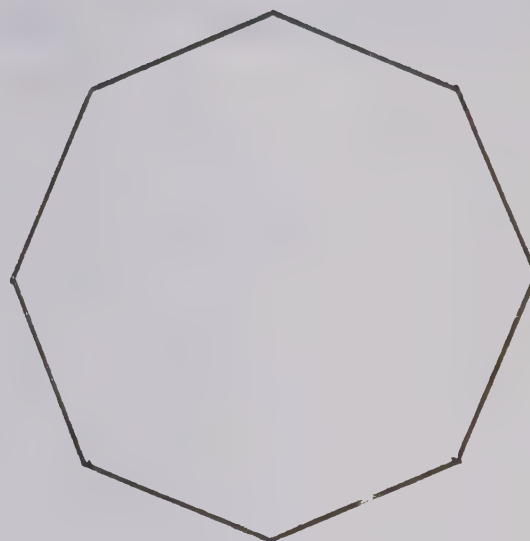


2. List the polygons in which the dotted lines are lines of symmetry. Use your mirror to check. (a), (d), (e)



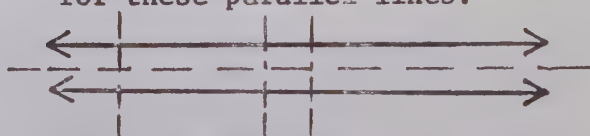
3. Trace the following figures very carefully. Cut out your tracings and locate all lines of symmetry by folding.

8 LINES OF SYMMETRY



6 LINES OF SYMMETRY

4. (a) Draw four lines of symmetry for these parallel lines.



- (b) How many possible lines of symmetry are there?

INFINITE NUMBER

DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

UNIT: VII

OBJECTIVE NO: 11

OBJECTIVE: Obtain the rotation image for any polygon.

$\frac{1}{2}, \frac{1}{4}, \frac{3}{4}$ cw, cc

MATERIALS:

Dot paper, clear acetate sheet, overhead

SUGGESTED DEVELOPMENT: 1. Prepare a transparency of a polygon and its image as in Diagram 1.

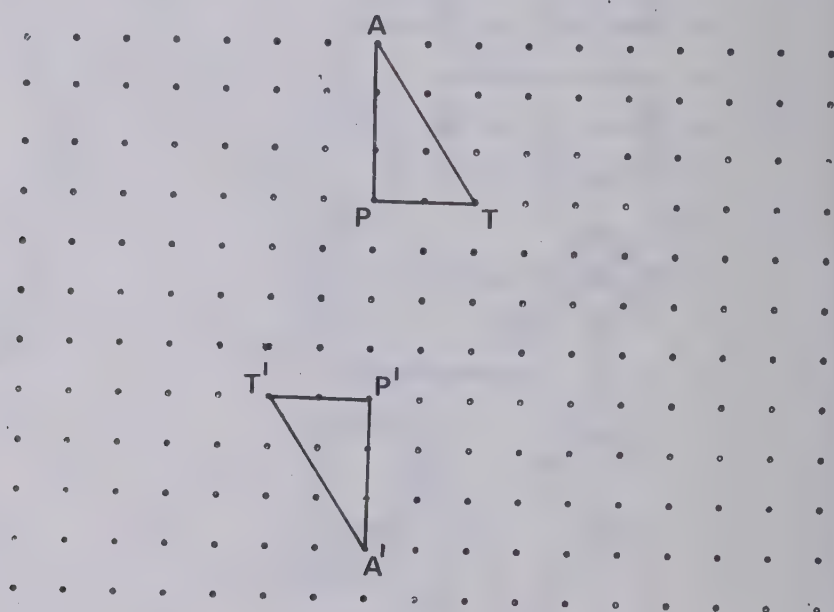


DIAGRAM 1

2. Demonstrate to students that $\triangle PAT$ and $\triangle P'A'T'$ are congruent but cannot be reproduced by a slide or a reflection.
3. Discuss with students the type of motion that is necessary to produce the image. (TURN).

4. Discuss with students the requirements for a turn:
- (a) original
 - (b) turn center
 - (c) amount of turn given by a turn arrow or a turn command
 - (d) image
5. Prepare a transparency as in Diagram 2.

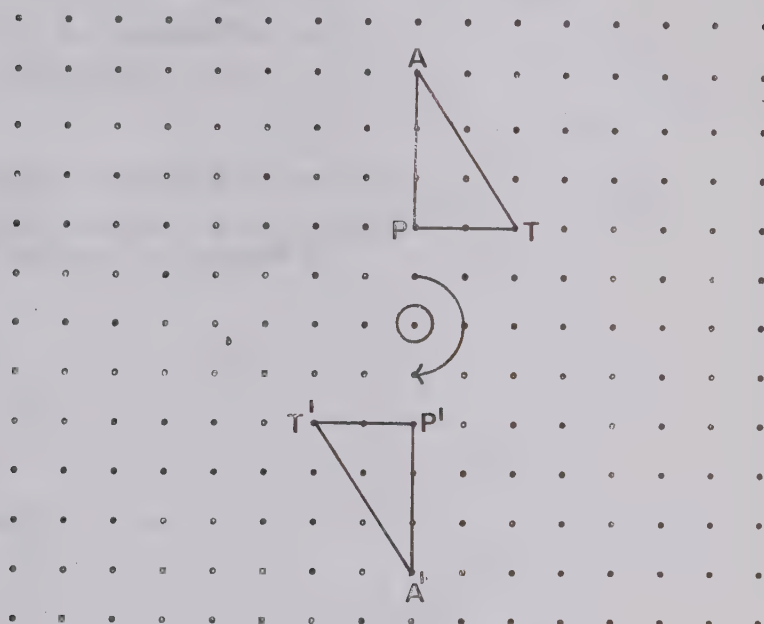


DIAGRAM 2

Discuss with students:

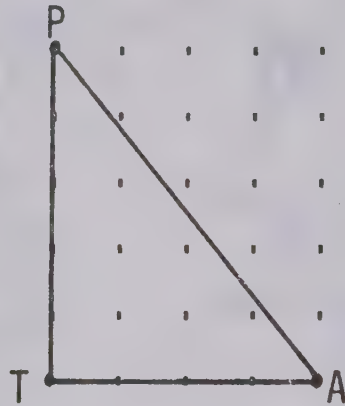
- (a) the need for a turn center
- (b) the turn arrow - which indicates the amount ($\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$) and direction (clockwise or counter-clockwise) of the turn
- (c) notation for the turn command,
e.g. $\odot \curvearrowright = \frac{1}{4}$ cw, $\odot \curvearrowleft = \frac{1}{2}$ ccw.

6. Demonstrate to students the method of doing a turn.
 - (a) Trace original, turn center, and turn arrow.
 - (b) Rotate the original so that the tail of the turn arrow falls on the head of the turn arrow.
 - (c) Transfer the vertices of the figure onto your dot paper. Complete the figure. Label correctly.

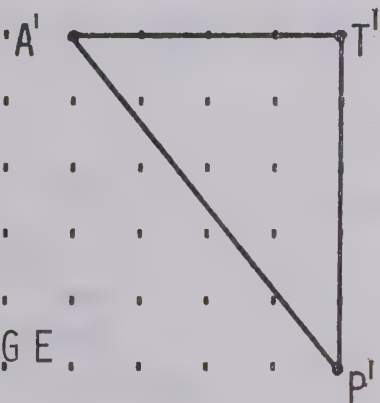
Note: Always place a turn center on your paper. This is the axle of your turn. Diagram 2 shows that the corresponding vertices are the same distance from the turn center.

7. Set up a "Goes To" table showing the correspondences between the original and the image.

TURNS

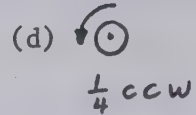
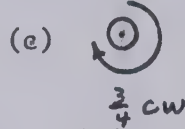
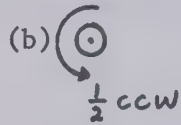
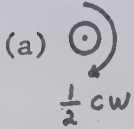


O.R I.G I.N A.L

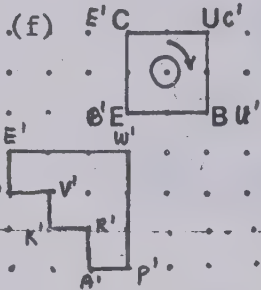
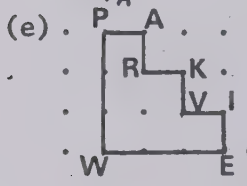
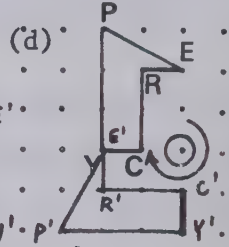
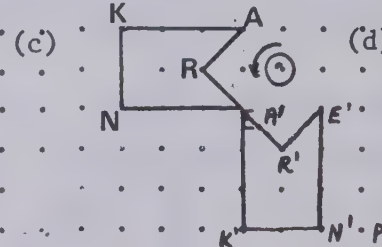
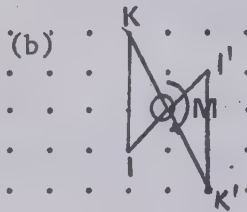
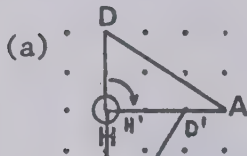


I M A G E

1. Write the notation to describe the following turns.



2. Copy each figure on to your dot paper and draw the turn image for each one.

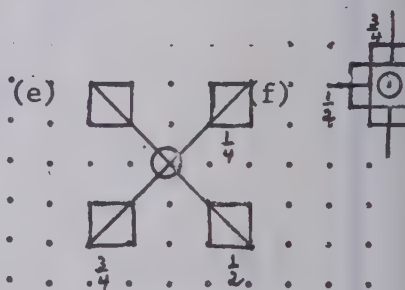
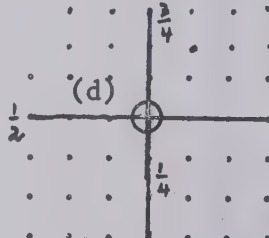
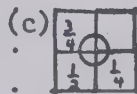
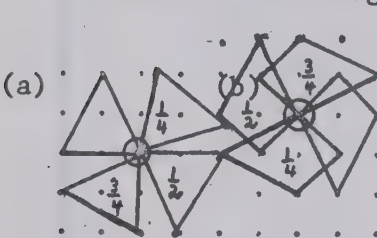


A 180° Turn is called a
Half-Turn

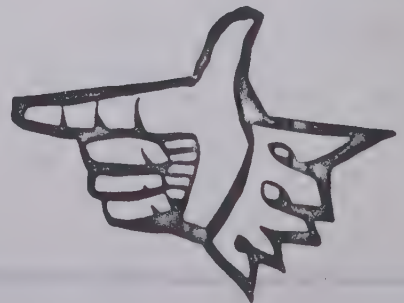
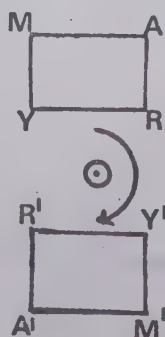
(g) What happens to polygon CUBE under any turn of $(\frac{1}{4}, \frac{1}{2}, \frac{3}{4})$ using the given turn center?

IMAGE MAPS ON ORIGINAL

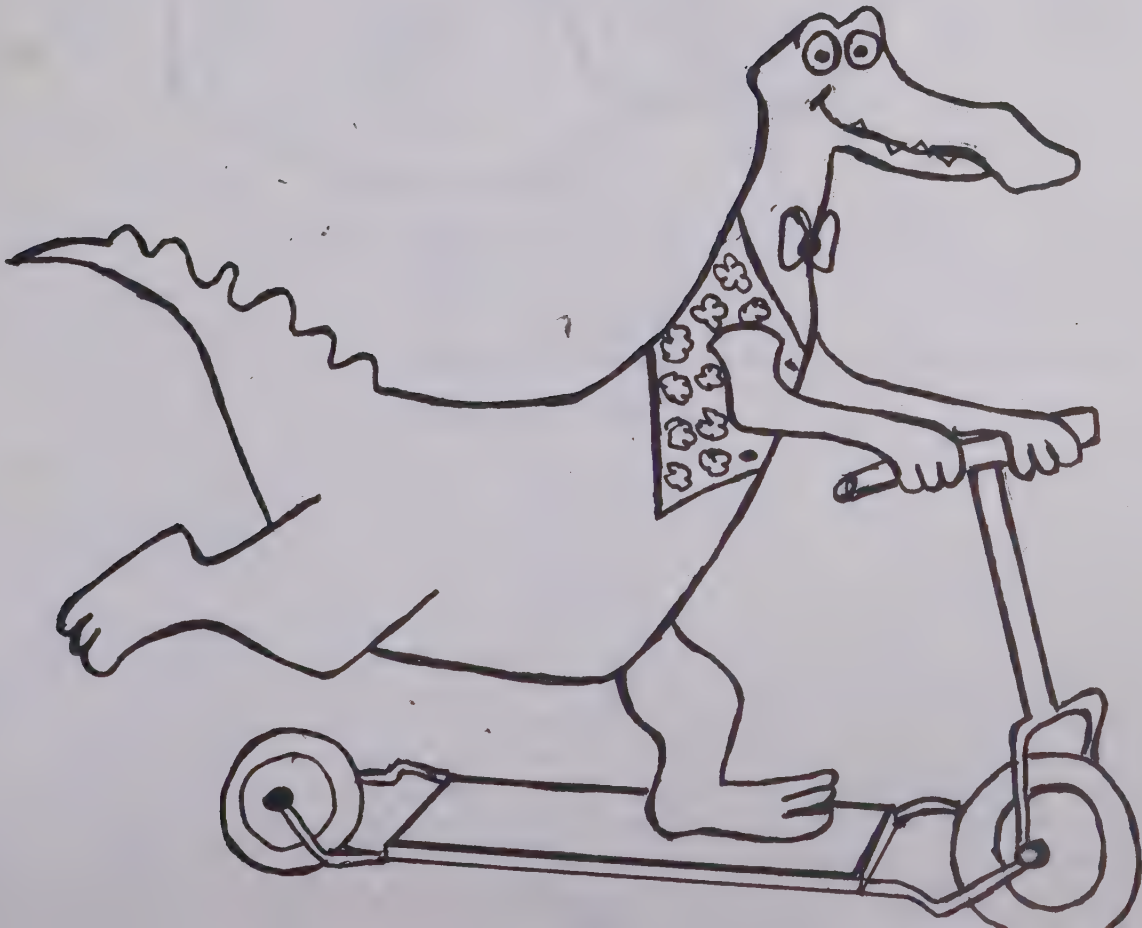
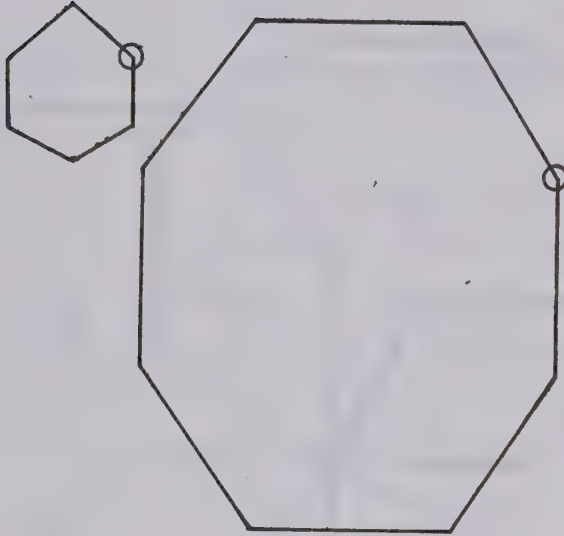
3. Copy the following on to your dot paper. Draw turn image for $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$, cw for all the diagrams.

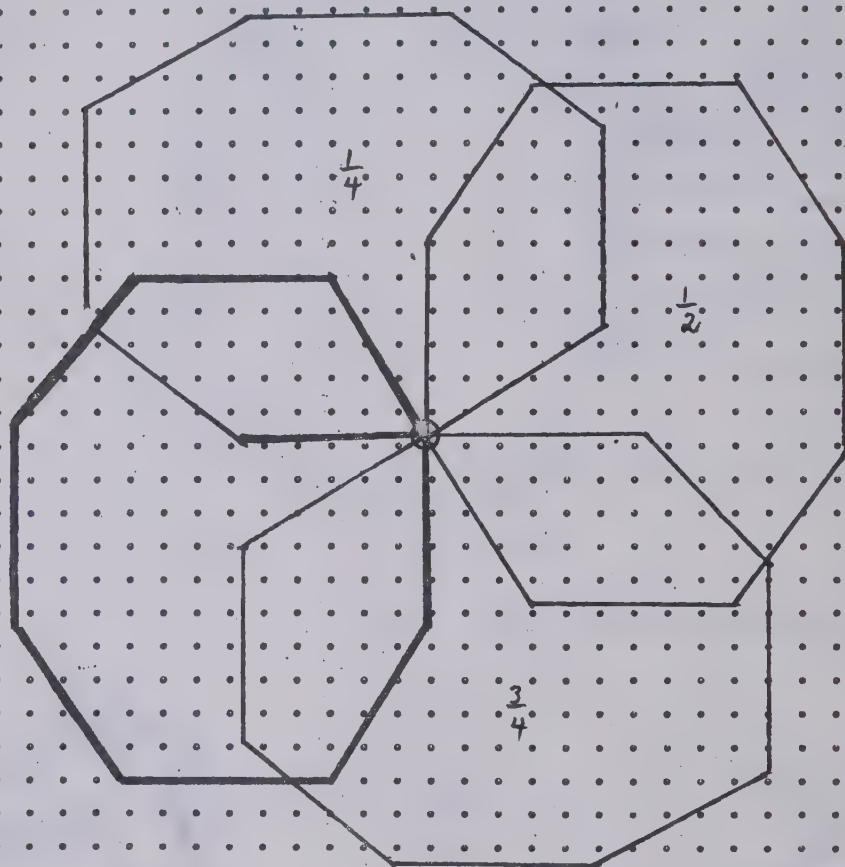
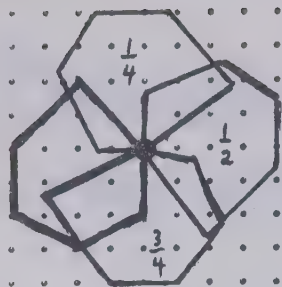


LABEL ALL DIAGRAMS -



4. Trace each figure on to your paper and draw the $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ cw images for each polygon.





DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

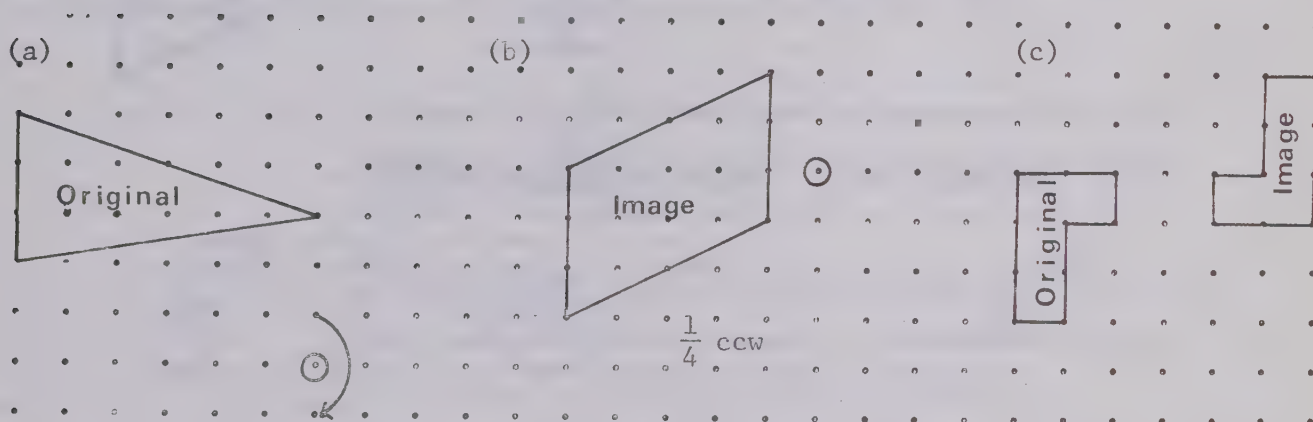
UNIT: VII

OBJECTIVE NO: 12

OBJECTIVE: Fill in the necessary requirements to complete diagrams for the motion of a turn.

MATERIALS: Dot paper

- SUGGESTED DEVELOPMENT:
1. Review the procedure for obtaining the turn image of a polygon.
 2. Point out that the completed diagram has 4 parts: original, image, turn center, and turn command.
 3. Present students with the following diagrams and then fill in the missing parts.



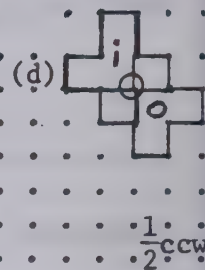
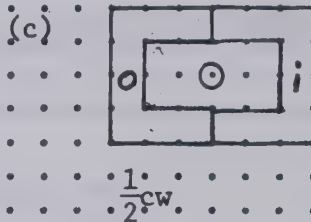
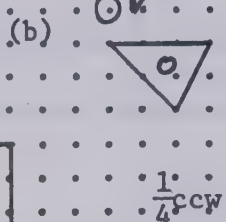
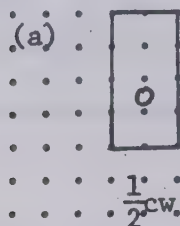
4. Make sure that the student realizes that he may use either a turn arrow or the "cw", "ccw" notation.
5. Tracing is a good method of checking to see if the answers are correct.

EXERCISES:

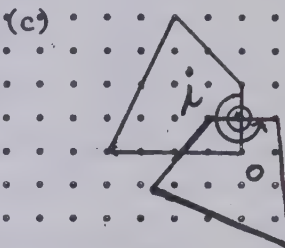
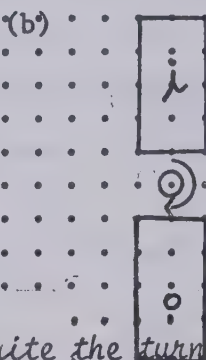
OBJECTIVE NO. 12

A. Copy on to your dot paper and draw:

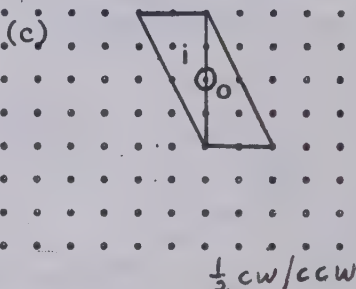
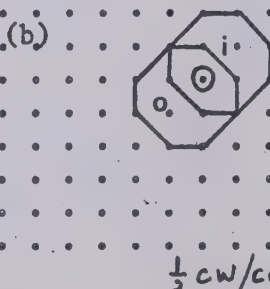
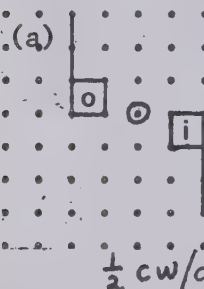
1. the turn images



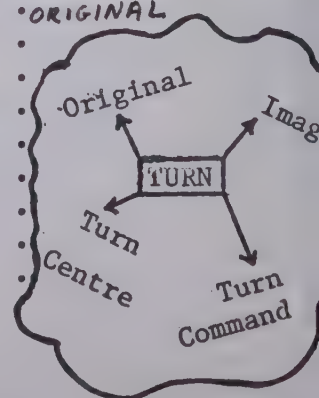
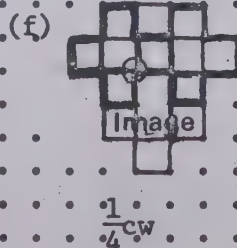
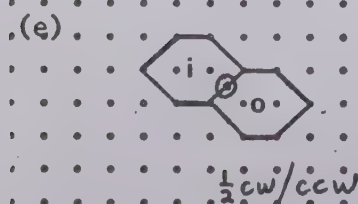
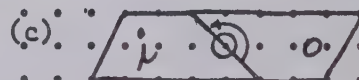
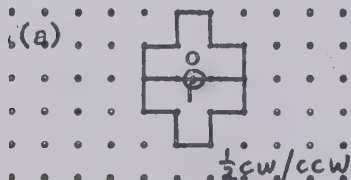
2. the original



3. the turn center. Write the turn notation.



B. Copy onto your dot paper and put in the missing components.



DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

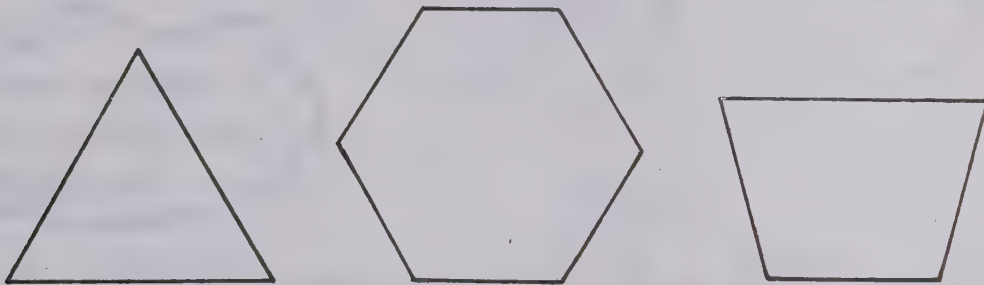
UNIT: VII

OBJECTIVE NO: 13

OBJECTIVE: Find the turn symmetries of a given figure.

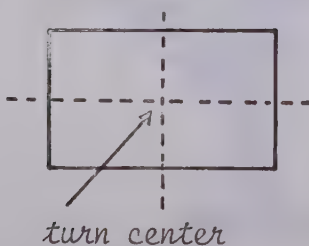
MATERIAL: Dot paper, acetate, overhead projector

SUGGESTED DEVELOPMENT: 1. Prepare a transparency of the following figures.

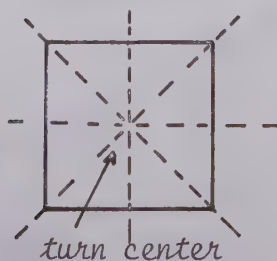


2. Project the figures and have students estimate the number of times that a tracing of the figure would map onto the original during one complete turn.
3. A *TURN SYMMETRY* occurs when image maps onto original. The number of times a tracing fits on the original in one complete turn is called the *ORDER*.
 e.g. a quadrilateral has turn symmetry of Order One.
 a rectangle has turn symmetry of Order Two.
 a square has turn symmetry of Order Four.
4. Demonstrate the turn symmetries of the projected figures and state the order.
5. Turn centers for any polygon of Order two or more may be located by finding the point of intersection of the lines of symmetry. e.g.:

(a) rectangle
Order 2



(b) square
Order 4



(c) star
Order 5

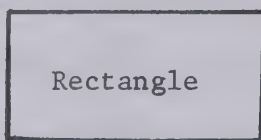


EXERCISES:

OBJECTIVE NO. 13

1. Trace the following figures and determine the order of turn symmetry of each.

(a)



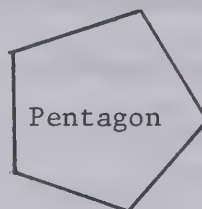
2

(b)



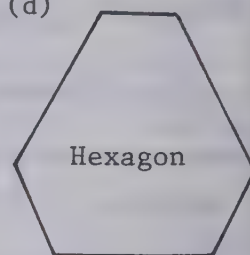
1

(c)

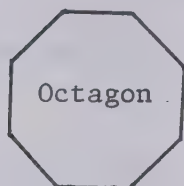


5

(d)

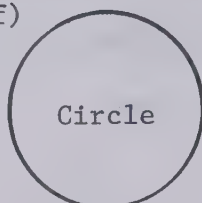


(e)



8

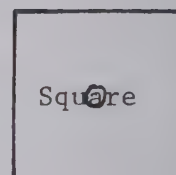
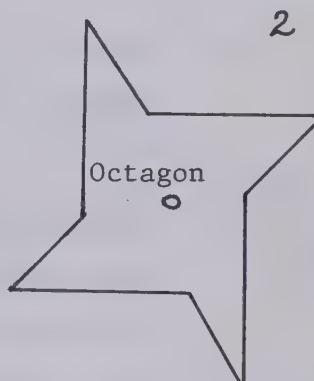
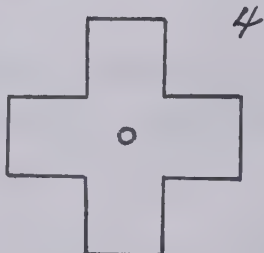
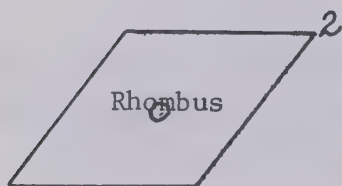
(f)



infinite

A TURN that maps a figure onto itself is called a TURN SYMMETRY.

2. Find the turn center and the order of turn symmetry for each figure below.

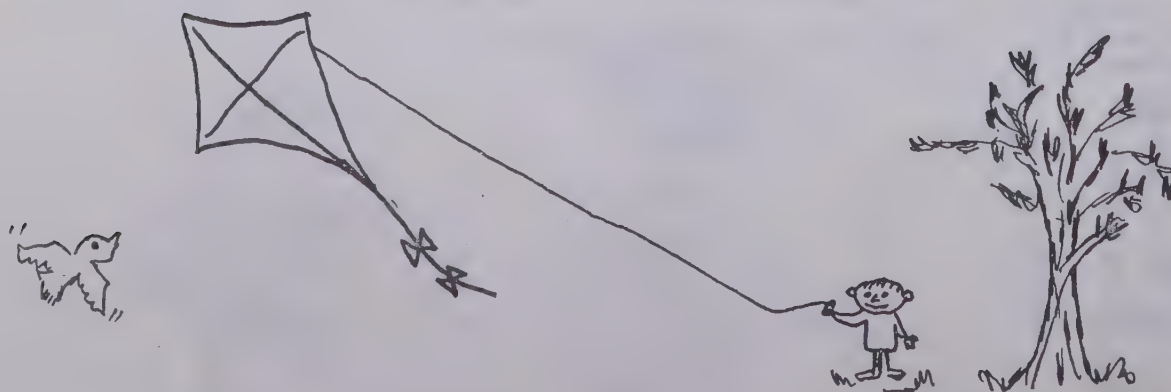


3. Which of the capital letters have a $\frac{1}{2}$ turn symmetry?

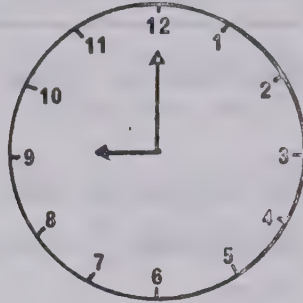
H, I, N, O, S, X, Z

4. The numeral 1961 has half-turn symmetry. Can you find other numerals with half-turn symmetry?

101, 609, 619, 906, etc



5. A clock can be used to tell time by observing the position of the hands (minute and hour) as they rotate about the centre of the clock dial. Below are 8 turns for the minute and hour hands on a clock. Give the time interval in minutes or hours for each turn represented. Use the clock dial in the diagram to help you.



TURN

Minute Hand

- $\frac{1}{2}$ c.w. = 30 minutes
 $\frac{1}{4}$ c.w. = 15 "
 $\frac{3}{4}$ c.w. = 45 "
 1 c.w. = 60 "

Hour Hand

- $\frac{3}{4}$ c.w. = 9 hours
 $\frac{1}{4}$ c.w. = 3 "
 1 c.w. = 12 "
 $\frac{1}{2}$ c.w. = 6 "

6. Given the final time and the turn arrow for each hand, find the original time. (Hint: Draw in the time on clock and use c.c.w. arrow.)

- (a) Final time - 11:30 A.M. Original time is 11:15 A.M.

$\frac{1}{4}$ c.w. (minute hand)

- (b) Final time - 9:15 A.M. - 12:15 A.M.

$\frac{3}{4}$ c.w. (hour hand)

- (c) Final time - 5:45 P.M. - 5:15 P.M.

$\frac{1}{2}$ c.w. (minute hand)

- (d) Final time - 7:00 P.M. - 4:00 P.M.

$\frac{1}{4}$ c.w. (hour hand)

- (e) Final time - 1:15 P.M. - 7:15 A.M.

$\frac{1}{2}$ c.w. (hour hand)

- (f) Final time - 2:30 A.M. - 1:45 A.M.

$\frac{3}{4}$ c.w. (minute hand)

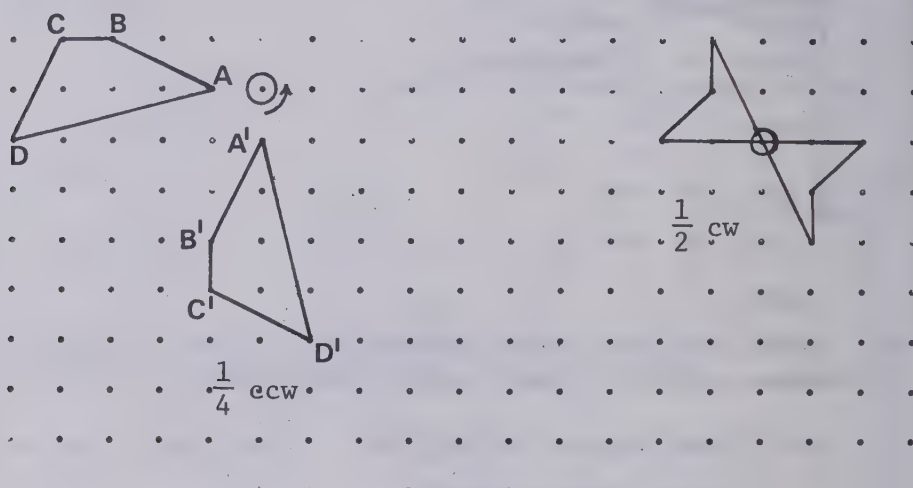
STRAND: GeometryLEVEL: 7UNIT: VIIOBJECTIVE NO: 14

OBJECTIVE: *To determine the rotation image for any polygon after a combination of two turns.

MATERIALS: Overhead, transparencies (clear and dot), felt pens, student dot paper.

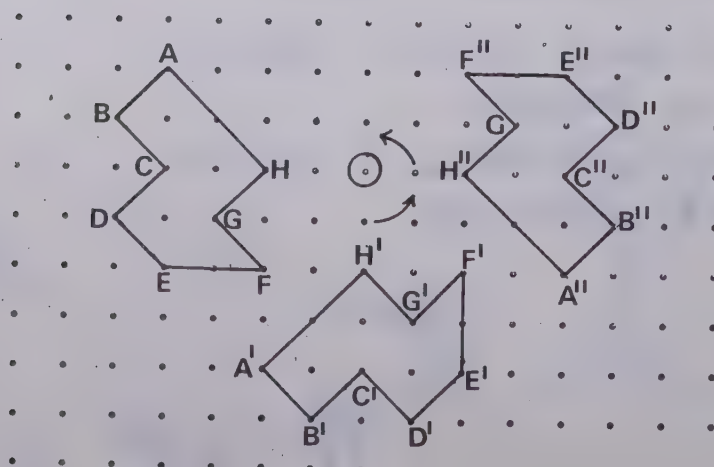
SUGGESTED METHOD: 1. Present any polygon on your overhead dot paper and proceed to review the $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ turns in both directions as in Figure 1 below.

FIGURE 1



2. Present the same polygons as Figure 1 and do any two two turns, being certain to retain the same turn center. Be certain to stress that the first image may or may not be drawn but must be used to find the second image. An example is shown in Figure 2.

FIGURE 2



NOTE: With a class of more able students, you may wish to discuss that if the turn center remains constant, turns are commutative, and associative when three or more are performed.

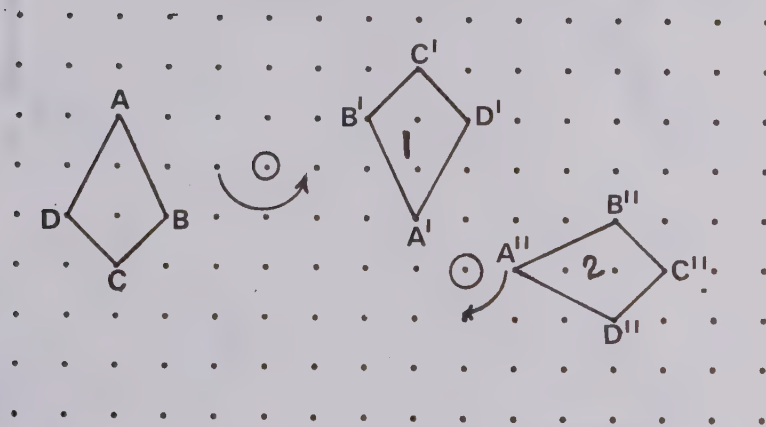
Point out that the operations of addition and subtraction may be applied.

e.g. $\frac{1}{4}$ c.w. followed by $\frac{1}{2}$ c.w. could be replaced by $\frac{3}{4}$ c.w.

3. Present any polygon with two turns and images. Be certain to have two distinct turn centers. Stress that the first image may or may not be drawn, but must be used to find the second image.

An example is shown in Figure 3.

FIGURE 3

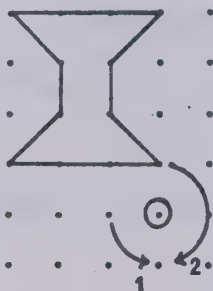


EXERCISES:

OBJECTIVE NO. 14

Copy the following diagrams on your dot paper and find the turn images as required.

(a)

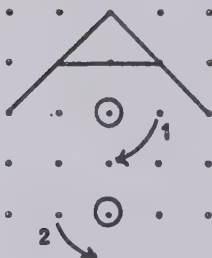


(d)

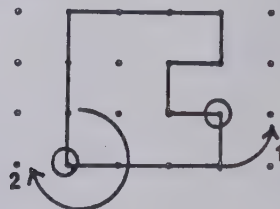


see next page

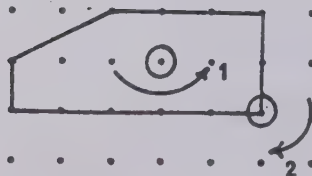
(b)



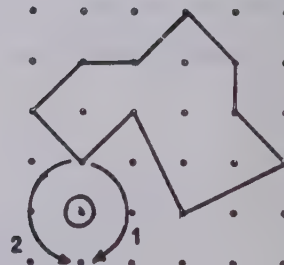
(e)



(c)

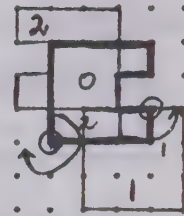
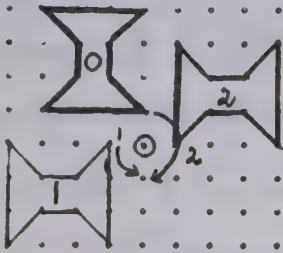


(f)

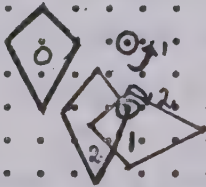
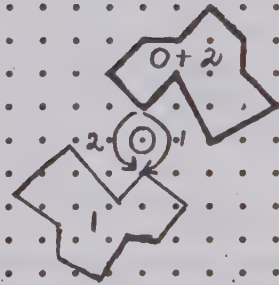
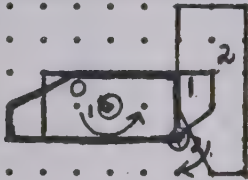
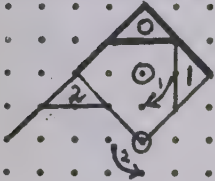


Use the first image
to find the second image.

(e)



(f)



STRAND: GeometryLEVEL: 7UNIT: VIIOBJECTIVE NO: 15

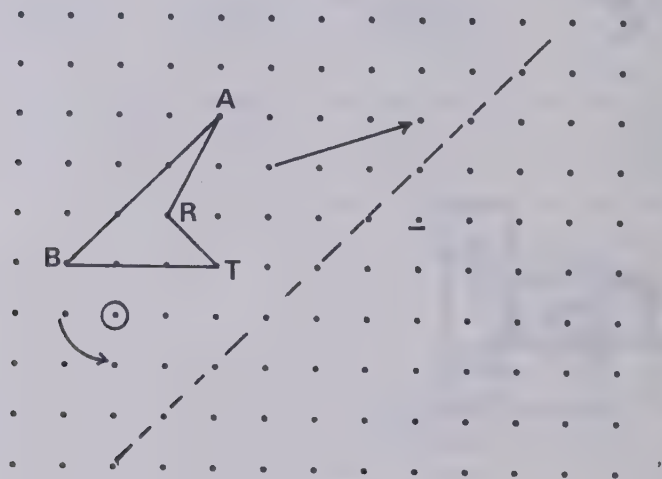
OBJECTIVE: Determine whether a pair of congruent figures were produced by a turn.

MATERIALS:

Overhead projector, dot transparency, dot paper.

SUGGESTED DEVELOPMENT:

1. Using polygon BART instruct your students to perform a slide, a flip and a turn on the polygon in three separate diagrams.



2. Discuss the differences between the location of each of the images. The images will be congruent but will occupy different positions.
3. Set up a "Goes To" table for the motion of a turn and name the corresponding congruent parts.

EXERCISES:

OBJECTIVE NO. 15

1. In the diagram below name the motion used to produce each of the images.

(a) TURN	(b) FLIP	(c) TURN	(d) FLIP
(e) TURN	(f) SLIDE	(g) TURN	(h) TURN
(i) TURN FLIP	(j) TURN FLIP	(k) SLIDE FLIP	(l) TURN SLIDE
(m) FLIP FLIP	(n) TURN FLIP	(o) TURN SLIDE	(p) FLIP
(q) TURN SLIDE	(r) FLIP	(s) FLIP	(t) TURN FLIP

2. (a) The six faces of a die are pictured below. Draw $\frac{1}{4}$ c.w., $\frac{1}{2}$ c.w., $\frac{3}{4}$ c.w. images for each face. Below each diagram state whether the image could also be produced by a slide or flip or both from the original.

(i)					ORDER 4
		BOTH	BOTH	BOTH	
(ii)					ORDER 2
		FLIP	SLIDE	FLIP	
(iii)					ORDER 2
		FLIP	SLIDE	FLIP	
(iv)					ORDER 4
		BOTH	BOTH	BOTH	
(v)					ORDER 4
		BOTH	BOTH	BOTH	
(vi)					ORDER 2
			BOTH		

- (b) List those faces which have turn symmetry of order 1, 2, 3, 4.
 (c) List those faces whose images all could have been produced by all three motions. (i), (iv), (v)

3. (a) Choose the pair of congruent figures that are produced by a turn.
 (b) Set up a "Goes To" table for the pair of figures from (a) and name the corresponding congruent parts.

JANET \cong CHRIS

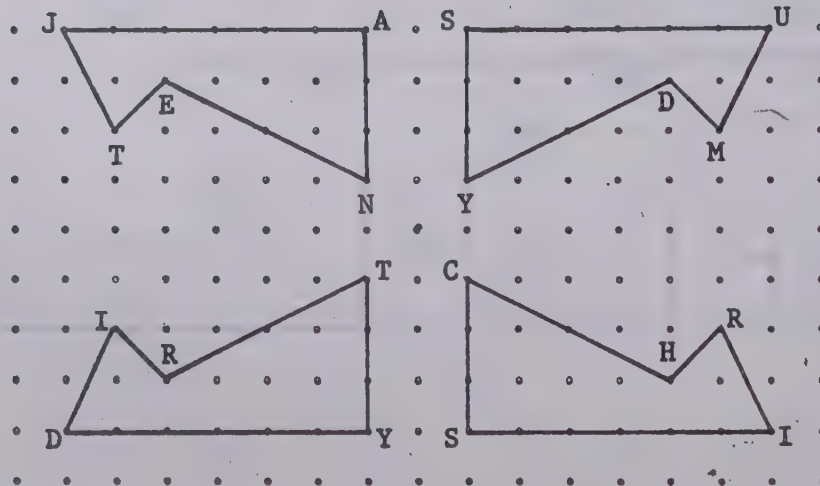
J \rightarrow I
 A \rightarrow S
 N \rightarrow C
 E \rightarrow H
 T \rightarrow R

$\overline{NA} \cong \overline{CS}$

$\overline{TJ} \cong \overline{RI}$

$\angle ANE \cong \angle SCH$

$\angle TJA \cong \angle RIS$



SUMDY \cong IRT

S \rightarrow Y
 U \rightarrow D
 M \rightarrow I
 D \rightarrow R
 Y \rightarrow T

$\overline{DY} \cong \overline{RT}$

$\overline{MD} \cong \overline{IR}$

$\angle DYS \cong \angle RIT$

$\angle YSU \cong \angle TIR$

DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

UNIT: VII

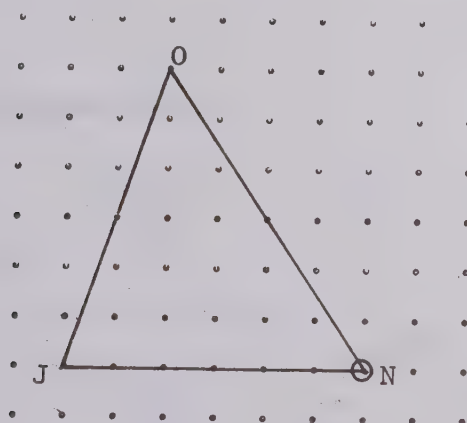
OBJECTIVE NO: 16

OBJECTIVE: Complete an invariance table for the slide reflection and one-half turn.

SUGGESTED DEVELOPMENT: 1. Prepare a transparency of an invariance table.

Motion Characteristics	Slide	Reflection	$\frac{1}{2}$ Turn
length			
angle			
congruence			
parallelism			

2. Have students draw $\triangle JON$ on their dot paper and perform a slide (3R, 0), a reflection, and $\frac{1}{2}$ turn clockwise, (three different diagrams).

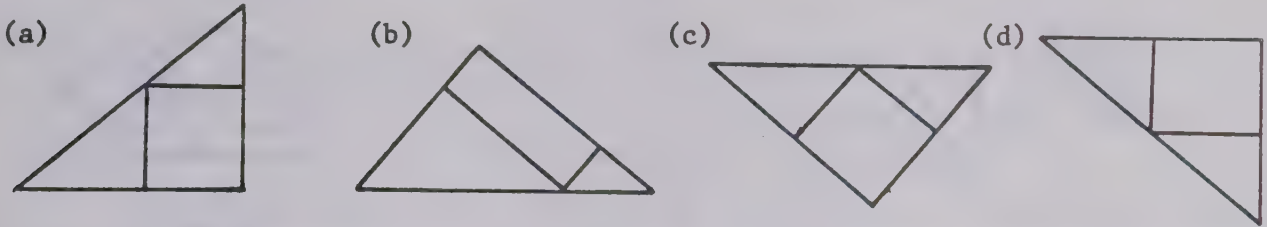


3. Discuss each diagram with the students with relation to each of the characteristics and decide which are invariant.

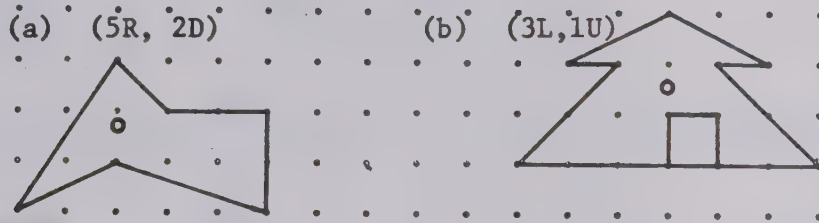
4. Complete the table.

<div> <div>Motion</div> <div>Characteristics</div> </div>	Slide	Reflection	$\frac{1}{2}$ Turn
length	yes	yes	yes
angle	yes	yes	yes
congruence	yes	yes	yes
parallelism	yes	only if the segment is parallel to the mirror line	yes

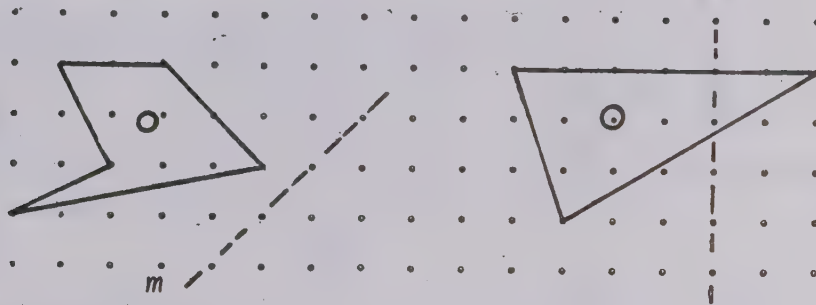
1. Choose the pair of figures that are congruent. (a) AND (c)



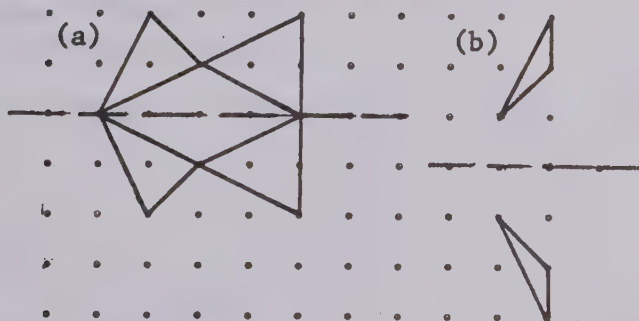
2. Find the slide image for each original below. The slide notation is given. Draw a slide arrow.



3. Find the mirror images for each original below.



4. Locate all mirror lines for each diagram below.



5. Trace the square, then draw the flip image. Answer the following questions.

- (a) State the number in the top left corner of the original. 1
State the number in the top left corner of the image. 2
- (b) State the number in the bottom right of the original. 4
State the number in the bottom right of the image. 3
- (c) Place a mirror on m ; do your answers for (a) and (b).
Check out? YES



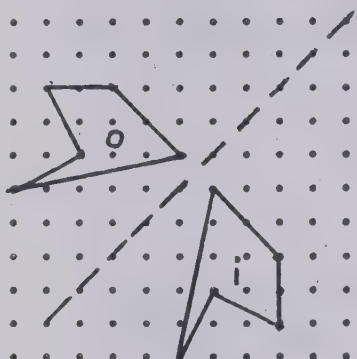
2. (a)



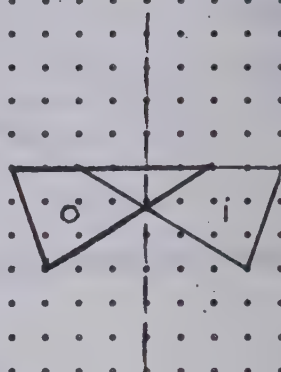
(b)



3. (a)



(b)



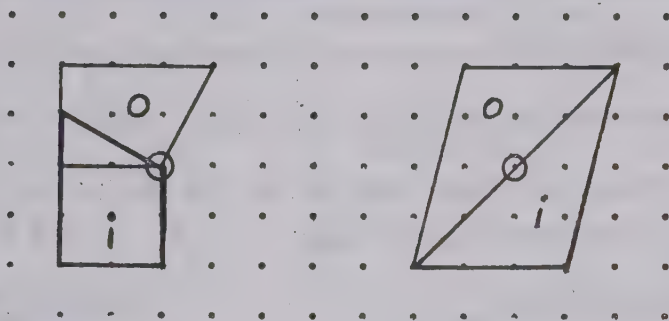
5.



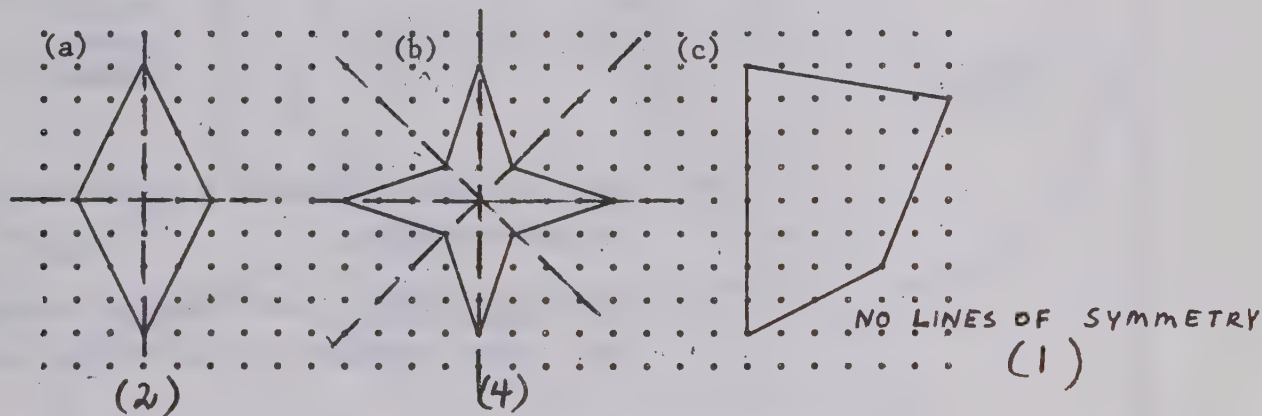
6. Locate the turn images for each original below.

(a) $\frac{1}{4}$ ccw

(b) $\frac{1}{2}$ cw

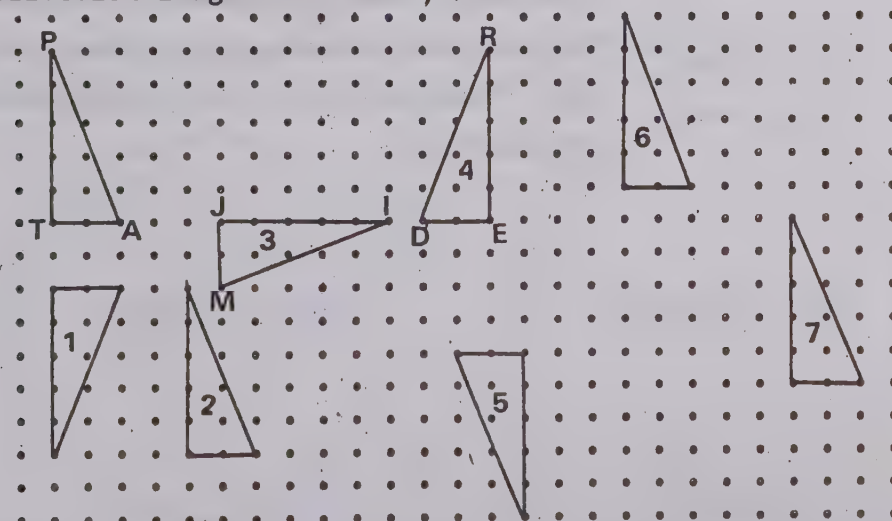


7. Locate *all* lines of symmetry and give the ORDER OF TURN SYMMETRY for each figure below.



8. List *all* figures which could be

- (a) Slide Images of $\triangle PAT$ 6, 2, 7
- (b) Turn Images of $\triangle PAT$ 3, 5
- (c) Reflection Images of $\triangle PAT$ 1, 4



- (d) Set up a "Goes To" table and name the corresponding congruent parts for $\triangle PAT$ and for
 - (i) $\triangle JIM$
 - (ii) $\triangle RED$

DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

UNIT: VII

OBJECTIVE NO: 17

OBJECTIVE: Classify polygons (limit: triangles, quadrilaterals, pentagons, hexagons, octagons, decagons).

SUGGESTED DEVELOPMENT: 1. Present a chart similar to the one below filling in the names as you go.

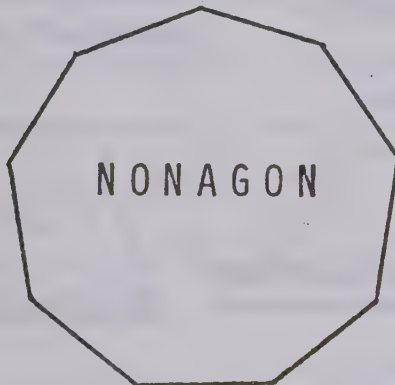
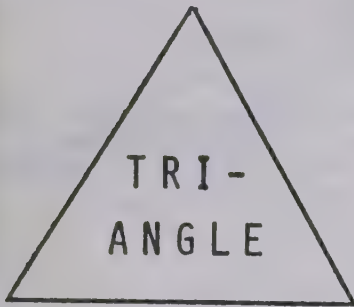
<u>No. of Sides</u>	<u>Name of Figure</u>
3	triangle
4	quadrilateral
5	pentagon
6	hexagon
8	octagon
10	decagon

NOTE: You may wish to include a discussion on regular polygons.

REGULAR POLYGONS: Are polygons having all sides congruent and all angles congruent.

2. (a) Prepare a large sheet containing many and various polygons.
- (b) Have students cut each one out and then group (classify) their polygons any way they choose.
- (c) Discuss each grouping and reasons for grouping. Then point out the grouping mathematicians use.

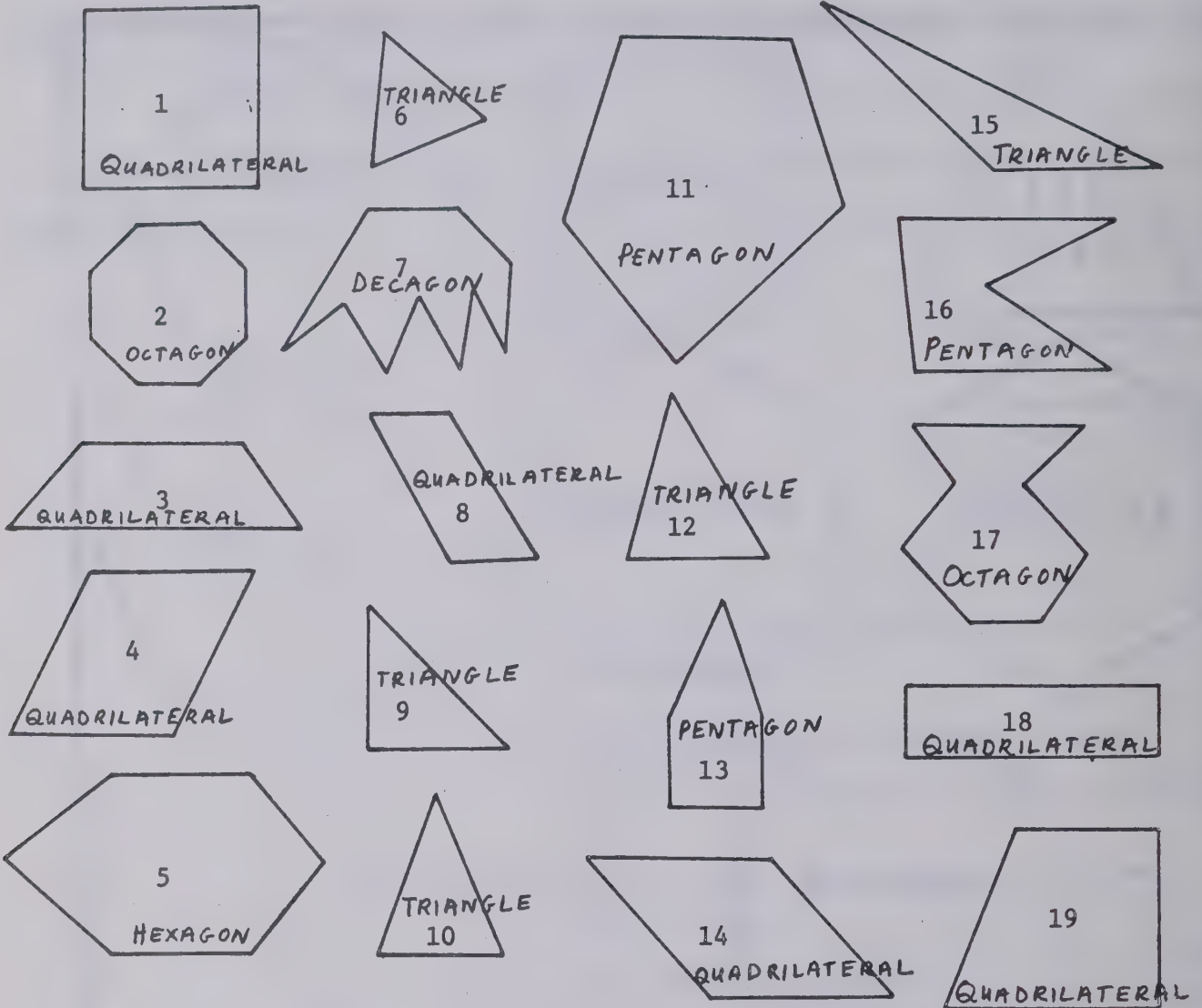
POLYGONS



EXERCISES:

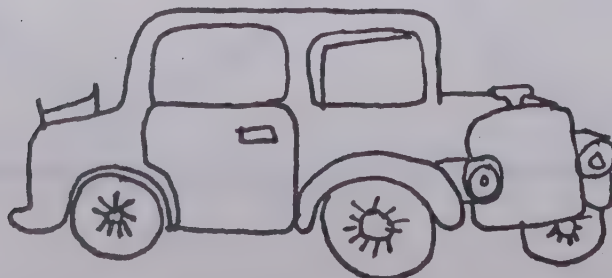
OBJECTIVE NO. 17

1. Classify each of the following polygons according to the number of sides.



2. Many highway traffic signs are polygons. Classify the following signs as to the type of polygon.

- | | |
|--------------------------|-------------------------------|
| (a) Stop OCTAGON | (d) Bus Stop QUADRILATERAL |
| (b) School Zone PENTAGON | (e) Speed Limit QUADRILATERAL |
| (c) Yield TRIANGLE | |



DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

UNIT: VII

OBJECTIVE NO: 18

OBJECTIVE: Using the number of lines of symmetry classify a triangle by its sides. NOTE: Include traditional classification.

- SUGGESTED DEVELOPMENT:
1. Present students with a prepared sheet of equilateral, scalene, and isosceles triangles.
 2. Have students find all lines of symmetry using a mirror or by folding.
 3. Have students fill out the table.

NO. OF CONGRUENT ANGLES	NO. OF CONGRUENT SIDES	NO. OF LINES OF SYMMETRY	KIND OF TRIANGLE

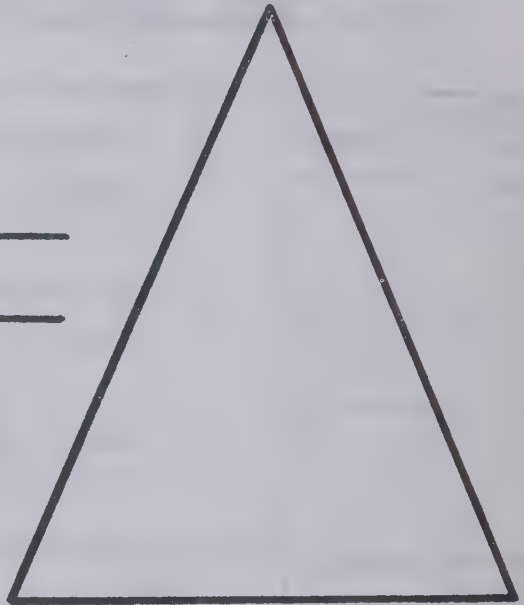
4. Definitions for each type of triangle can be obtained by discussion after the table is completed.
5. Pursue the reason why any triangle does not have two lines of symmetry.

CLASSIFICATION OF TRIANGLES

LINES OF SYMMETRY _____

CONGRUENT SIDES _____

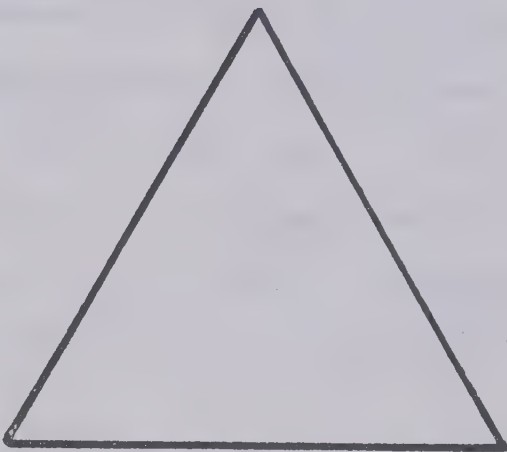
TYPE OF TRIANGLE _____



LINES OF SYMMETRY _____

CONGRUENT SIDES _____

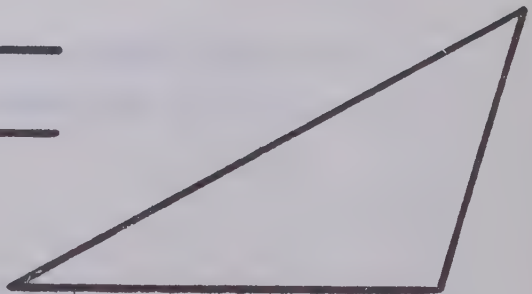
TYPE OF TRIANGLE _____



LINES OF SYMMETRY _____

CONGRUENT SIDES _____

TYPE OF TRIANGLE _____

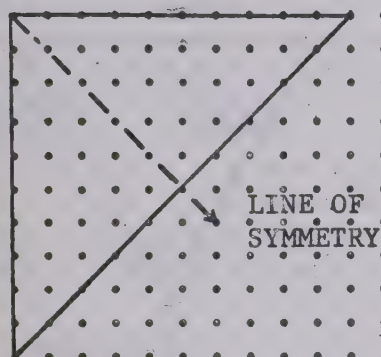


EXERCISES:

OBJECTIVE NO. 18

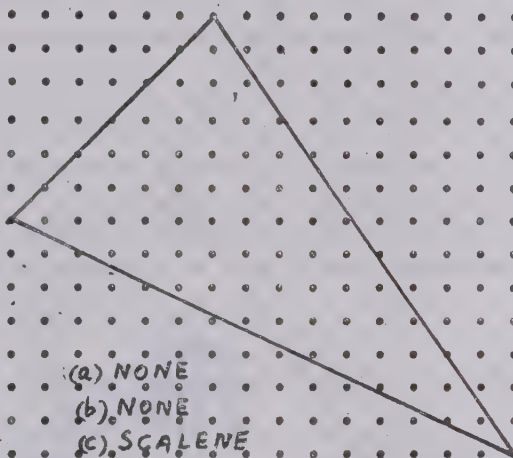
1. For each of the following triangles use a mirror, paper folding or tracing to help you find the (a) number of lines of symmetry (b) number of congruent sides (c) type of triangle

(a)



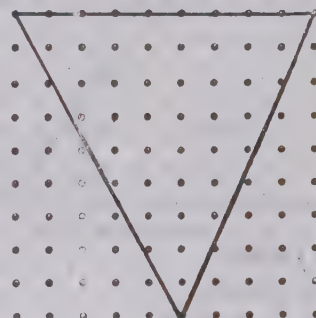
- (a) ONE
(b) TWO
(c) ISOSCELES

(b)



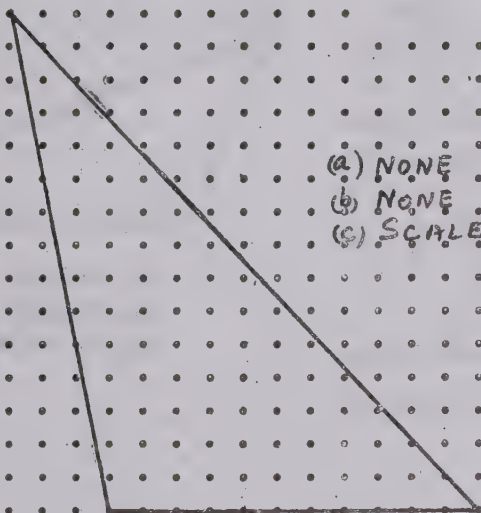
- (a) NONE
(b) NONE
(c) SCALENE

(c)



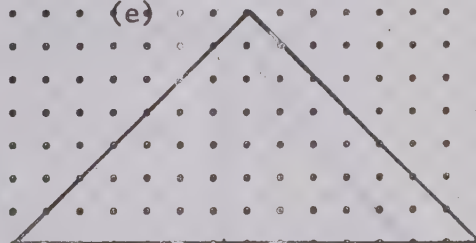
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(b) NONE
(c) SCALENE

(d)



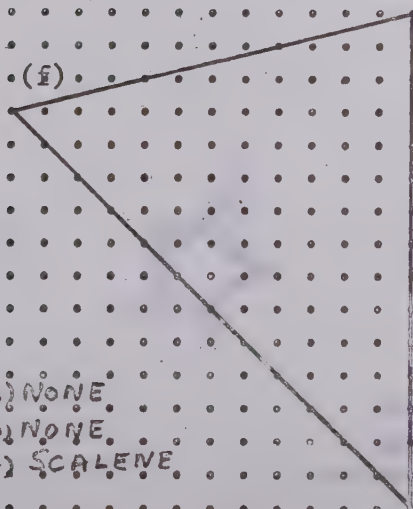
- (a) NONE
(b) NONE
(c) SCALENE

(e)



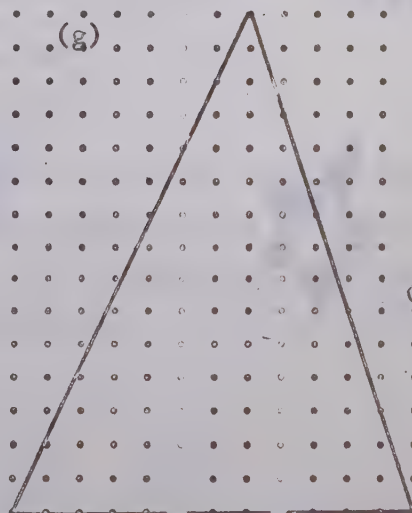
- (a) ONE
(b) TWO
(c) ISOSCELES

(f)



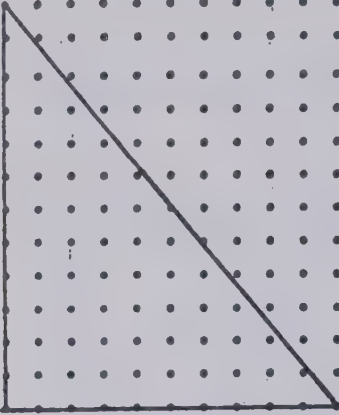
- (a) NONE
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(c) SCALENE

(g)



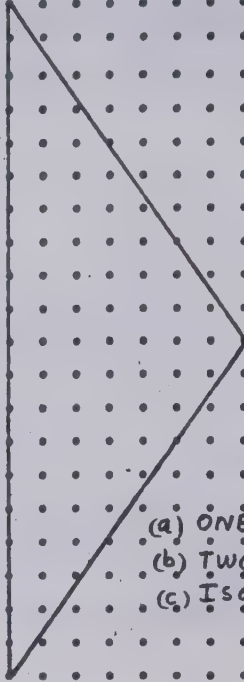
- (a) NONE
(b) NONE
(c) SCALENE

(h)



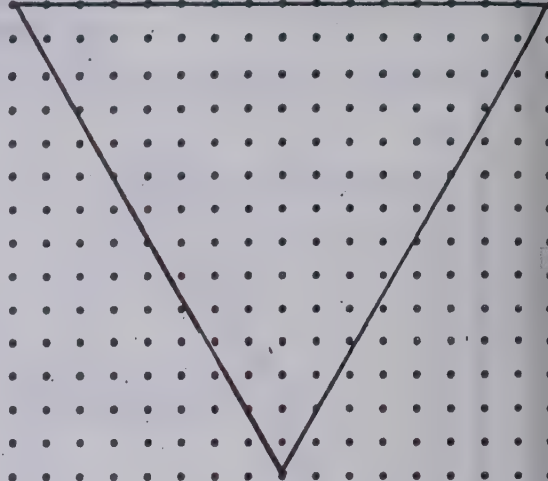
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(b) NONE
(c) SCALENE

(i)



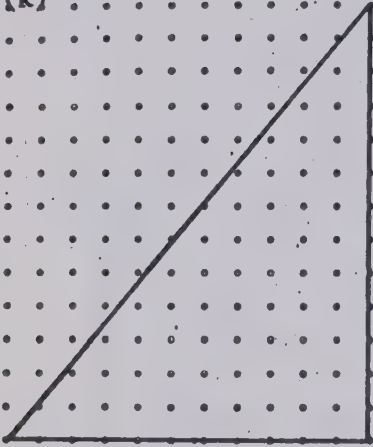
- (a) ONE
(b) TWO
(c) ISOSCELES

(j)



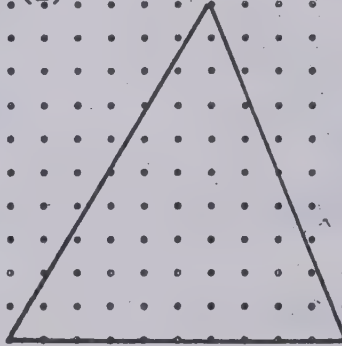
- (a) THREE
(b) THREE
(c) EQUILATERAL

(k)



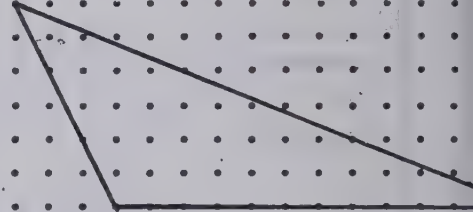
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(c) SCALENE

(l)



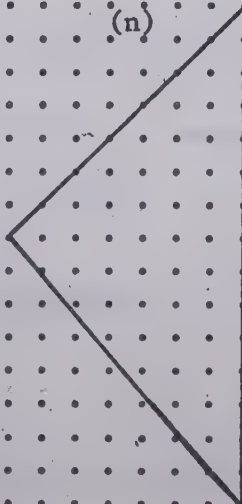
- (a) NONE
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(c) SCALENE

(m)



- (a) NONE
(b) NONE
(c) SCALENE

(n)

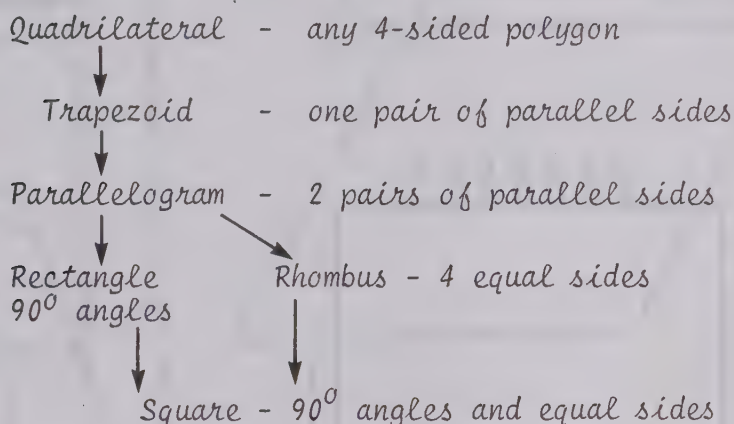


- (a) NONE
(b) NONE
(c) SCALENE

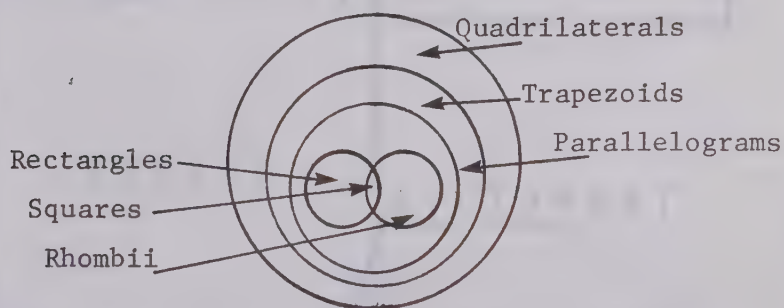


STRAND: GeometryLEVEL: 7UNIT: VIIOBJECTIVE NO: 19OBJECTIVE: Classify quadrilaterals.

- SUGGESTED DEVELOPMENT:
1. Distribute a copy of the following pages to each student. Ask the students to list as many features (properties) of each figure as they can. Discuss a possible classification scheme. Be prepared for diverse answers.
 2. Develop a hierarchy such as the one below.

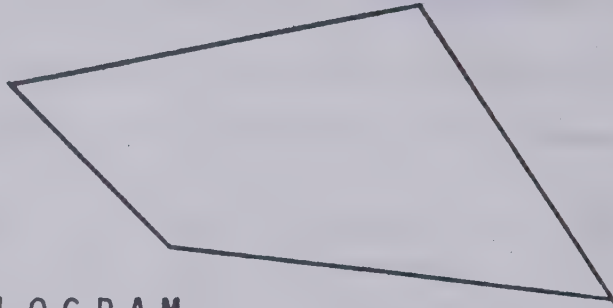


3. Develop a Venn diagram showing the relationship between quadrilaterals.



4. Direct students to name each figure with as many names as possible. But emphasize the BEST name. e.g. A square is also a rectangle, parallelogram, trapezoid, and quadrilateral.

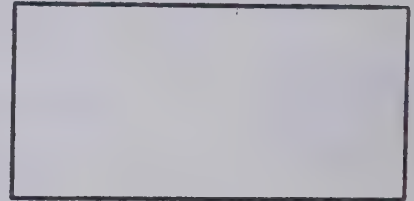
QUADRILATERALS



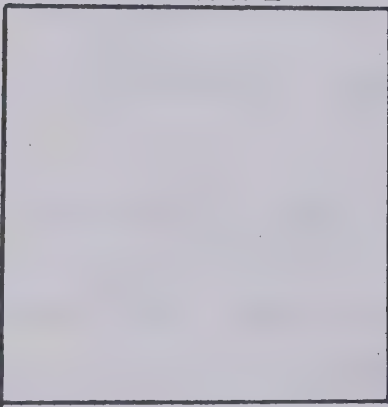
PARALLELOGRAM



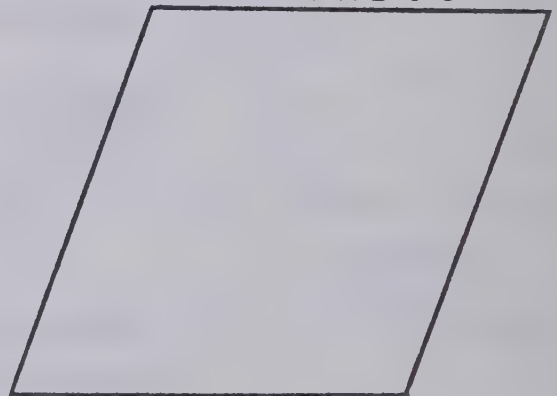
RECTANGLE



SQUARE



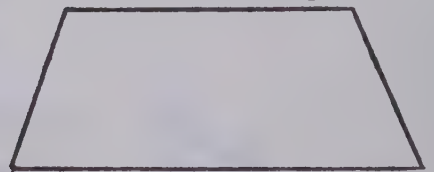
RHOMBUS



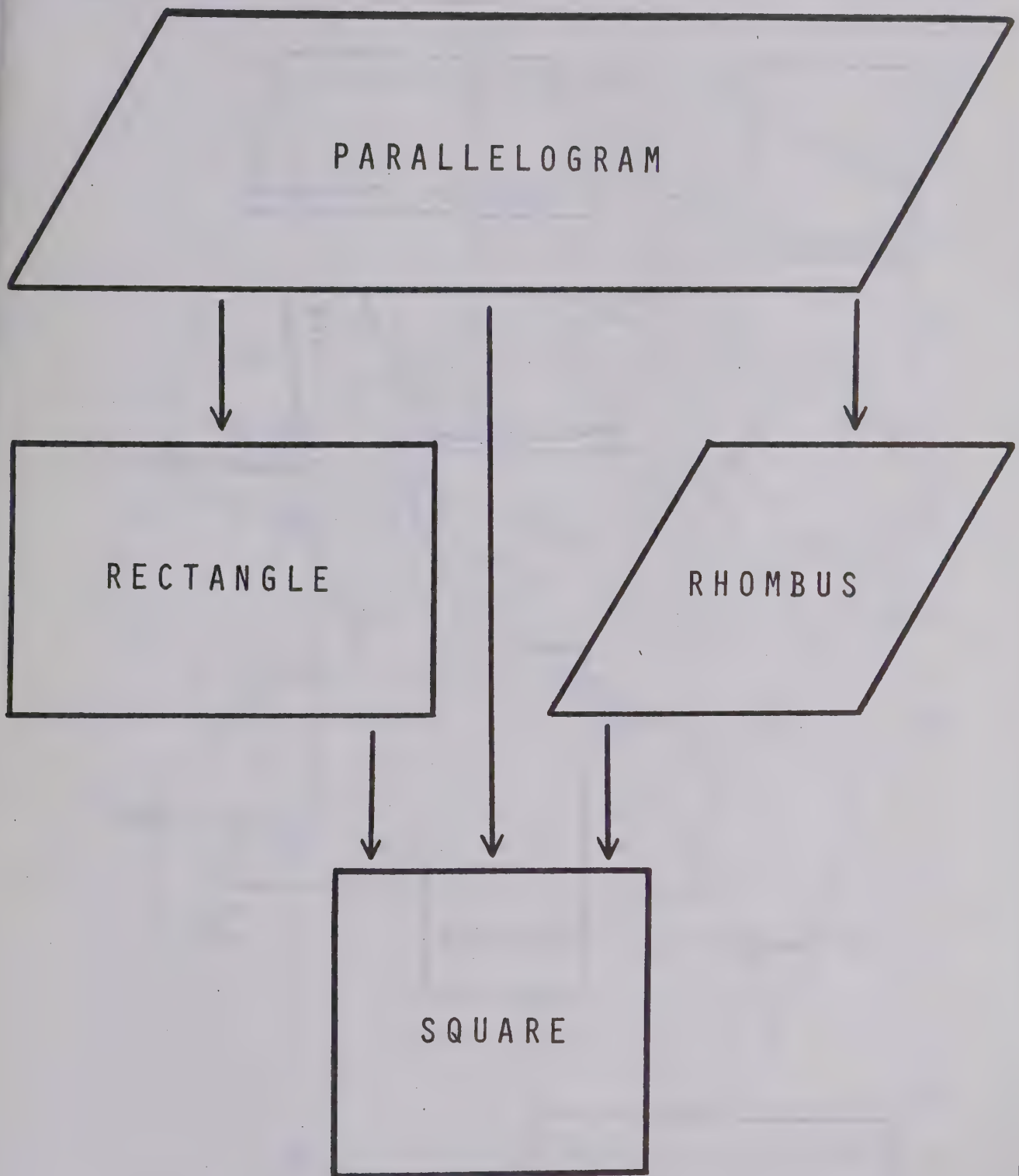
TRAPEZOID



ISOSCELES
TRAPEZOID



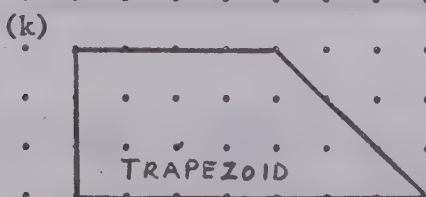
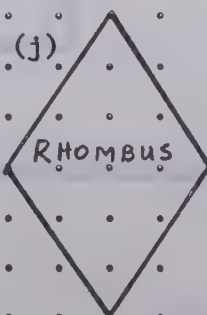
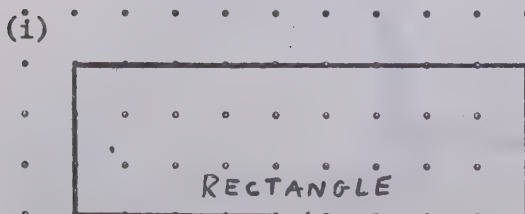
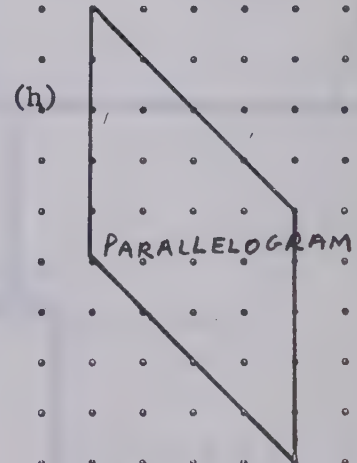
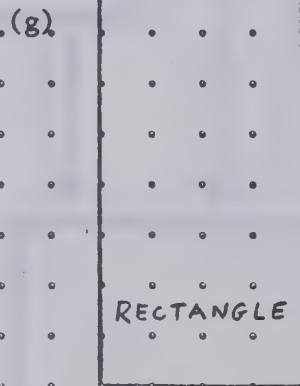
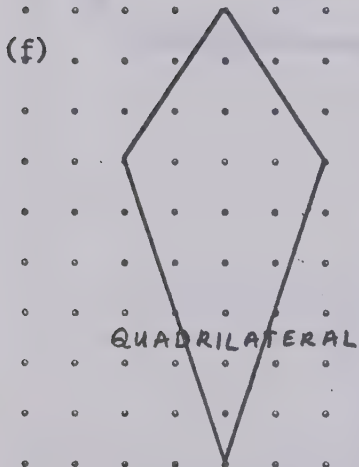
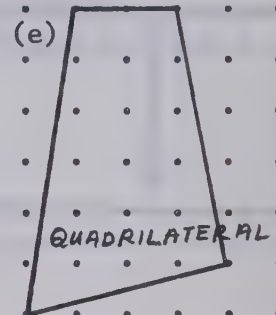
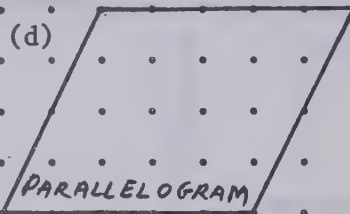
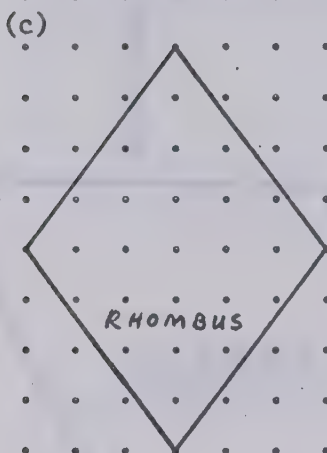
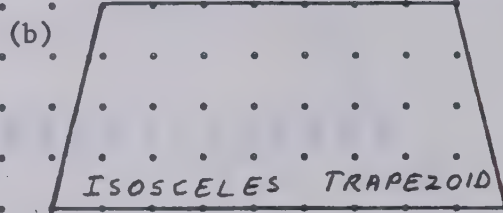
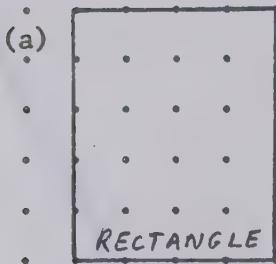
PARALLELOGRAMS



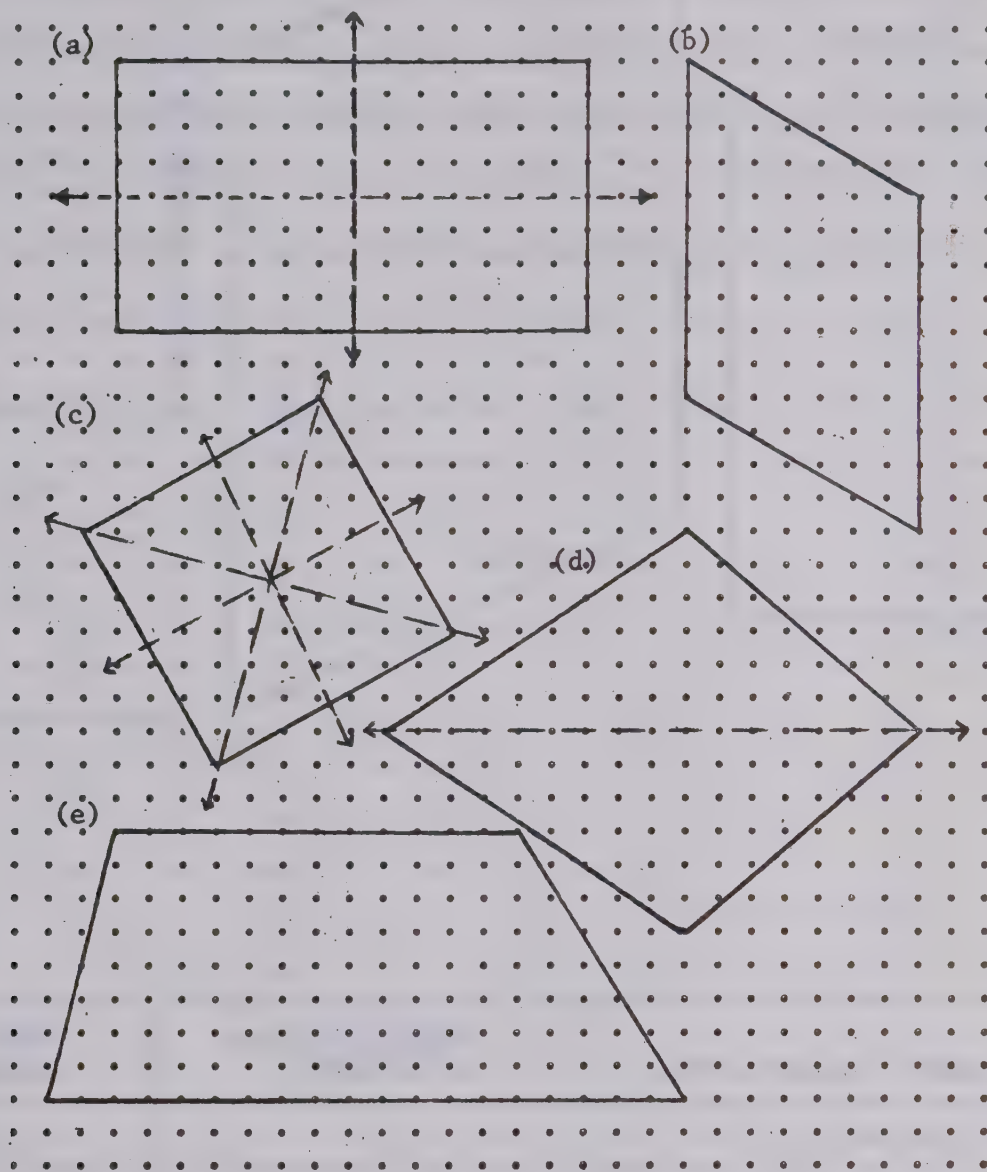
EXERCISES:

OBJECTIVE NO. 19

1. Give the BEST name for each of the following figures:

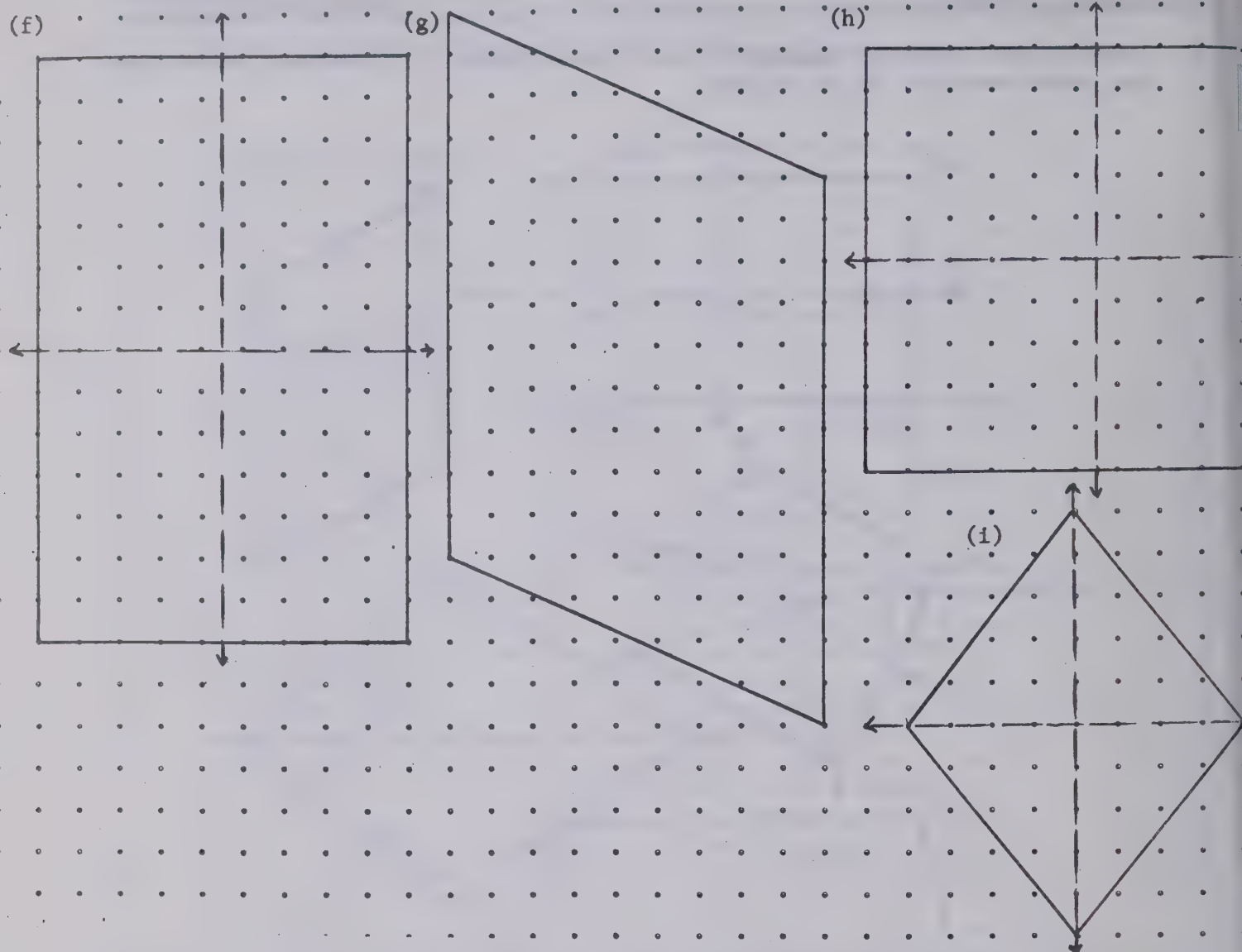


2. Find all the lines of symmetry of each quadrilateral. Construct the following table and fill in the blanks.



EXERCISES: (Cont'd.)

OBJECTIVE NO. 19



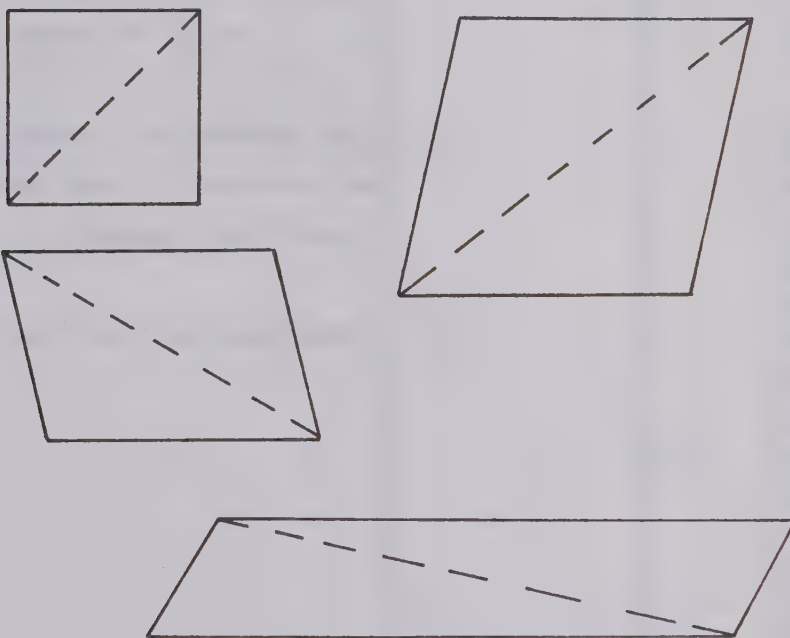
NAME OF QUADRILATERAL		NUMBER OF LINES OF SYMMETRY	NUMBER OF CONGRUENT SIDES
A	RECTANGLE	2	2 PAIRS
B	PARALLELOGRAM	0	2 PAIRS
C	SQUARE	4	4
D	QUADRILATERAL	1	2 PAIRS
E	TRAPEZOID	0	0
F	RECTANGLE	2	2 PAIRS
G	PARALLELOGRAM	0	2 PAIRS
H	RECTANGLE	2	2 PAIRS
I	RHOMBUS	2	4

STRAND: GeometryLEVEL: 7UNIT: VIIOBJECTIVE NO: 20

OBJECTIVE: Determine the properties for parallelograms, rectangles, squares and rhombii (use motions). (Limit: (i) opposite sides congruent; (ii) opposite angles congruent; (iii) opposite sides parallel; *(iv) diagonals bisect each other; *(v) diagonals bisect the figure; *(vi) diagonals of a rectangle and a square are congruent; *(vii) diagonals of a square and a rhombus are perpendicular.

SUGGESTED DEVELOPMENT: 1. Present class with parallelograms as in Diagram 1
Define diagonal.

DIAGRAM 1



2. Discuss the following questions with your class.
- What can you find out about the two figures that are formed by one diagonal?
 - How can this information lead you to properties of a parallelogram?

3. Use the transparency and a tracing to demonstrate how some of the properties of parallelograms may be demonstrated. i.e. opposite sides congruent by a slide; opposite angles congruent by a half turn.

4. Have the class:

- (a) construct a parallelogram, rectangle, square and rhombus,
- (b) draw the diagonals for each figure,
- (c) use the three motions to determine as many properties as possible for the figures.

Note: You may wish to place the students in pairs or teams.

5. List properties common to all figures (parallelograms) on the board. Make sure you force the student to justify each property.

6. Summarize the important properties.

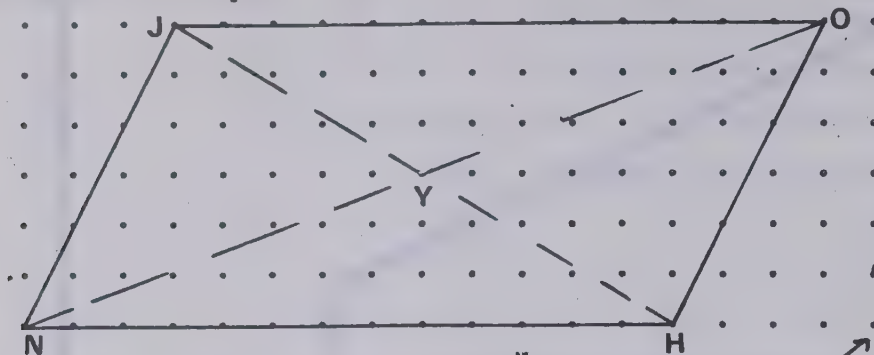
PROPERTIES OF PARALLELOGRAMS



EXERCISES:

OBJECTIVE NO. 20

1. Answer each of the questions below by referring to the diagram.



- (i) OPPOSITE SIDES \cong
 (ii) OPPOSITE ANGLES
 (iii) OPPOSITE SIDES
 PARALLEL
 (iv) DIAGONALS BISECT
 EACH OTHER
 (v) DIAGONALS BISECT
 THE PARALLELOGRAM

- (a) Is polygon JOHN a parallelogram? ^{Yes} Why? List reasons.
 (b) Name 2 pairs of congruent sides? $\overline{JO} \cong \overline{NH}$, $\overline{JN} \cong \overline{OH}$
 (c) Name 2 other pairs of congruent segments. $\overline{JY} \cong \overline{HY}$, $\overline{NY} \cong \overline{OY}$
 (d) Name 2 pairs of congruent angles from JOHN. $\angle JNH \cong \angle HOJ$, $\angle NHO \cong \angle OJN$
 (e) Name 2 pairs of congruent triangles formed by the diagonals of JOHN.
 (f) \overline{JO} is opposite what segment? \overline{NH} $\triangle JYN \cong \triangle HYO$, $\triangle JYO \cong \triangle HYN$
 (g) $\angle JOH$ is opposite what angle? $\angle HNJ$
 (h) $\angle YNH$ is congruent to what angle? $\angle YOJ$
 (i) $\angle JYO$ is congruent to what angle? $\angle HYN$

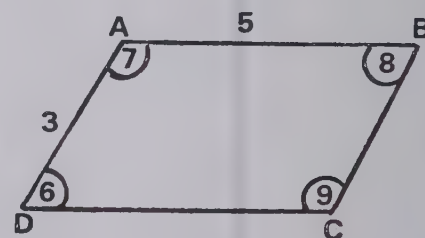
2.

Mystery Math

Each sentence below provides a number clue which can be used in MYSTERY MATH. Find all clues, using the diagram if necessary, to find the answers. All clues are about parallelograms.

CLUES

- (a) A parallelogram has 4 sides.
 The missing word is 4. Each "a"
 in the MYSTERY MATH would be replaced by a 4.
 (b) A parallelogram and one of its
 diagonals form 2 congruent triangles.
 (c) The number of the angle congruent to angle D. 8
 (d) The number of the side opposite to side DC. 5
 (e) The number of the angle opposite angle C. 7
 (f) The number of the side congruent to side BC. 3



MYSTERY MATH

(i)
$$\begin{array}{r} a\ b\ c\ f \\ \times d\ e \\ \hline \end{array}$$

$$\begin{array}{r} 4283 \\ \times 57 \\ \hline 244,131 \\ \hline \end{array}$$

(ii)
$$\begin{array}{r} a\ e\ d \\ - f\ b\ c \\ \hline \end{array}$$

$$\begin{array}{r} 475 \\ - 328 \\ \hline 147 \\ \hline \end{array}$$

?

DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

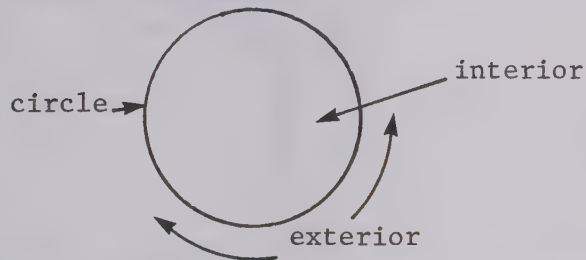
UNIT: VII

OBJECTIVE NO: 21

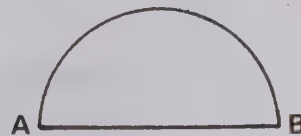
OBJECTIVE: To identify the parts of a circle. (Limit: interior, exterior, circle, center, radius, diameter, chord, arc, semi-circle, tangent and secant.)

SUGGESTED DEVELOPMENT: 1. Interior, exterior and the circle.

Draw a circle and identify for the students the interior of the circle, the exterior of the circle, and the circle itself.

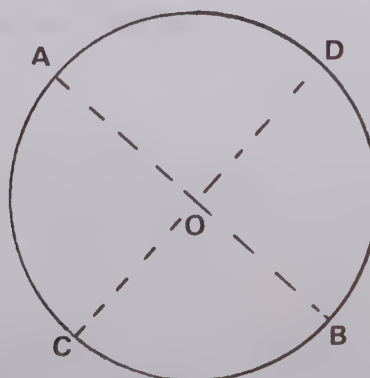


2. Diameter of a circle - have students construct a circle. Fold the circle upon itself. Crease the fold and then open. This fold line bisects the circle and is called the diameter.



NOTE: The circle has line symmetry with respect to line AB. A circle has an infinite number of lines of symmetry.

3. Center of a circle - fold two different diameters (fold circle upon itself twice). The diameters bisect each other at the center of the circle

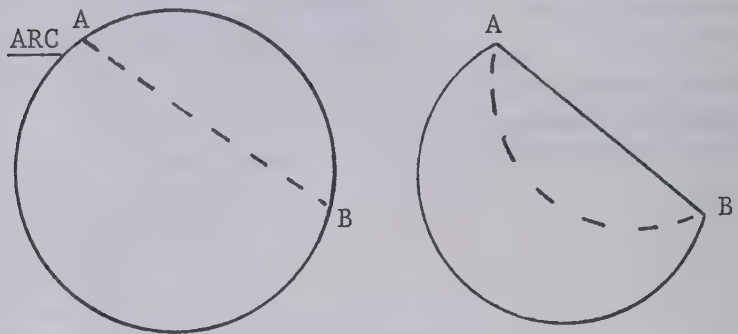


4. A Chord

A chord is any segment that has both end points on the circle.

Fold a circle upon itself to form a diameter.
Is this diameter a chord?

Fold the circle to form a chord that is not a diameter. e.g. \overline{AB} below.



Fold circle to form any chord. This separates the circle into 2 arcs. Refer to diagram for chord.

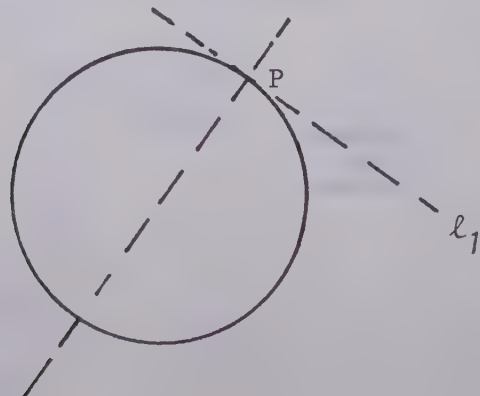
5. Semi-Circle (A Half Circle)

Fold a circle upon itself to form a diameter.
The diameter forms 2 semi-circles.

6. Tangent

Fold the diameter of the circle passing through given point P on the circle. At P fold the line (l_1) perpendicular to the diameter. l_1 is tangent to the circle.

NOTE: Do not cut out circle.

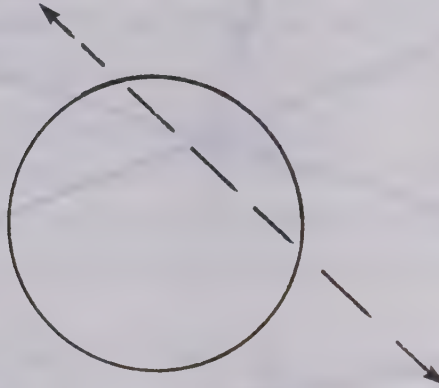


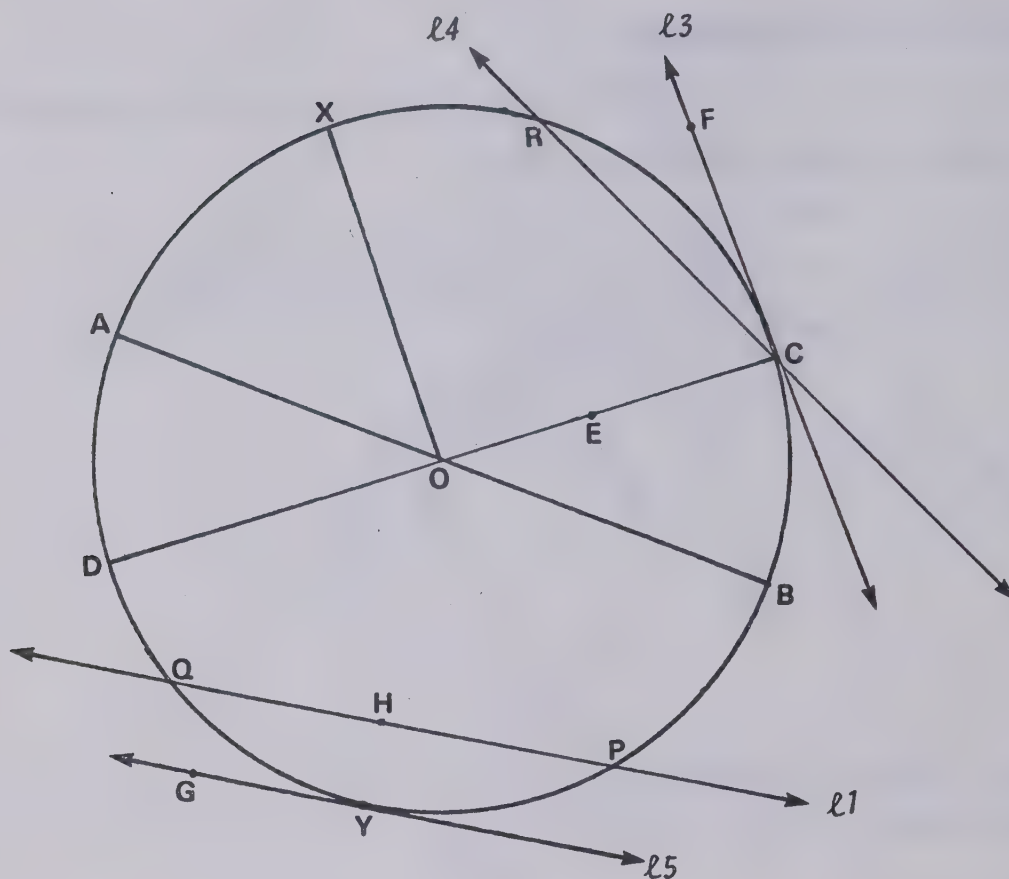
7. Secant

A line that intersects a circle at exactly two points.

Make any fold on circle, crease and open.

This line is a secant of the circle.





1. Name two diameters in the above circle. \overline{AB} , \overline{DC}
2. Name two chords that are not diameters. \overline{AP} , \overline{RC}
3. Name a chord that is a diameter. \overline{AB} , \overline{DC}
4. Name 3 arcs of the circle. \widehat{AX} , \widehat{XR} , \widehat{RC} , \widehat{CB} , \widehat{BP} , \widehat{PY} , \widehat{YQ} , \widehat{QD} , \widehat{DA}
5. How many semi-circles are there in the diagram? 4
6. Name 2 lines that are tangent to the circle. l_3 , l_5
7. Name all points indicated in the interior of the circle. H, O, E
8. Name all points indicated in the exterior of the circle. G, F
9. Name all points indicated on the circle. A, X, R, C, B, P, Y, Q, D



DEVELOPMENT AND EXERCISES

STRAND: Geometry

LEVEL: 7

UNIT: VII

OBJECTIVE NO: 22

OBJECTIVE: Determine the properties for the circle. (Motions make this very simple.)
(Limit: (i) diameters bisect the circle, (ii) diameters equal two
radii, (iii) the center is always equal distance from the circle.

SUGGESTED DEVELOPMENT:

1. Diameter bisects the circle.

Students should construct a circle of suitable size. Fold diameter of the circle and discuss how it divides the circle.

Alternate Development:

Place mirror on center. Observe that diameter is the line of symmetry of the circle. Therefore, the diameter bisects the circle.

2. Diameters equal two radii.

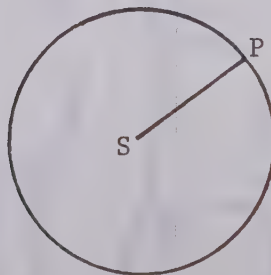
Construct a circle and draw a diameter. Cut out circle and fold diameter along itself. Observe that the two radii are congruent.

Alternate Development:

Place a mirror across the center so that one half of the diameter maps onto the other.

3. Center is always equal distance from the circle.

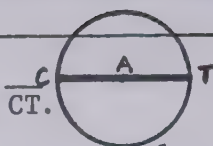
Draw circle S with radius \overline{SP} . Trace \overline{SP} and rotate about S. Stop 4 or 5 times, pointing out that the endpoint of the radius \overline{SP} is always on the circle. Therefore, the circle is always the same distance from the center.



EXERCISES:

OBJECTIVE NO. 22

1. (a) Draw Circle A with diameter \overline{CT} .

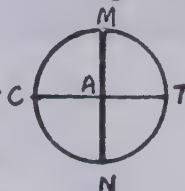


- (b) Use A as a turn center and execute a $\frac{1}{2}$ turn.

- (c) Does the circle have $\frac{1}{2}$ turn symmetry? YES

Therefore, \overline{CT} BISECTS the circle into two congruent figures.

2. (a) Draw Circle A with diameters \overline{CT} and \overline{MN} .

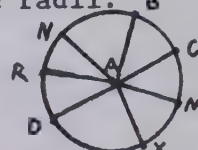


- (b) (i) Slide \overline{CA} onto \overline{AT} , are they \cong ? YES

- (ii) Slide \overline{MA} onto \overline{AN} , are they \cong ? YES

Therefore, a diameter is equal to TWICE the radii. B
(2)

3. (a) Draw Circle A and radii \overline{BA} , \overline{CA} , \overline{MA} , \overline{XA} , \overline{DA} , \overline{RA} , \overline{NA} .

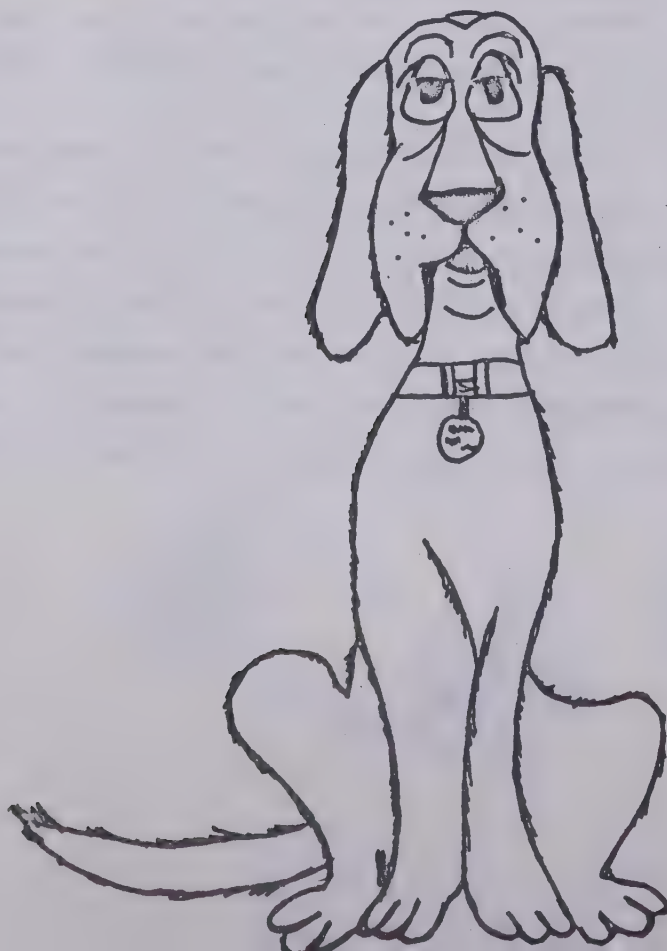


- (b) Use A as the turn center and turn \overline{BA} until it falls on each of the other radii, are they \cong ? YES

4. Turn \overline{BA} about turn center A for one complete turn.

Is the tracing of B on the circle throughout the turn? YES

Therefore, ALL the points which make up the circle are an Equal distance from the center.



STRAND: Geometry

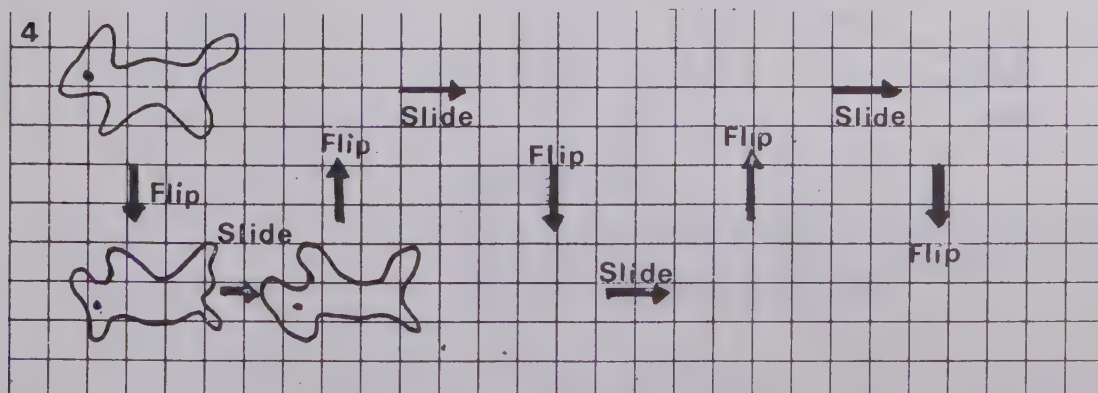
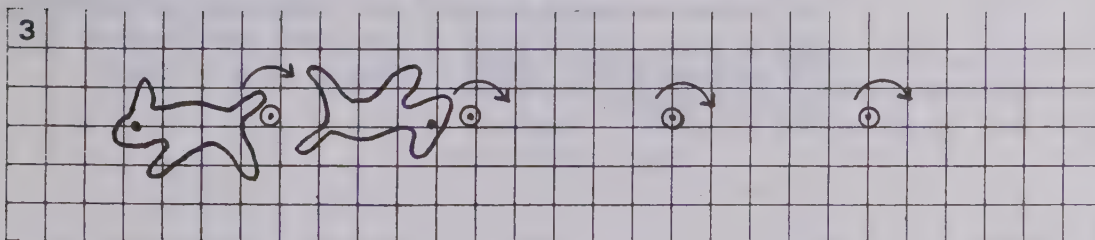
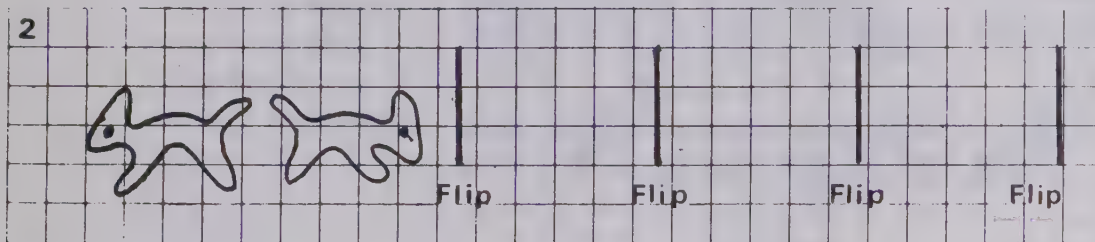
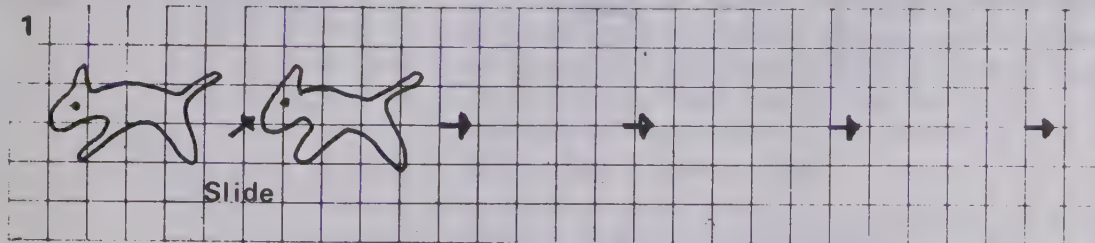
LEVEL: 7

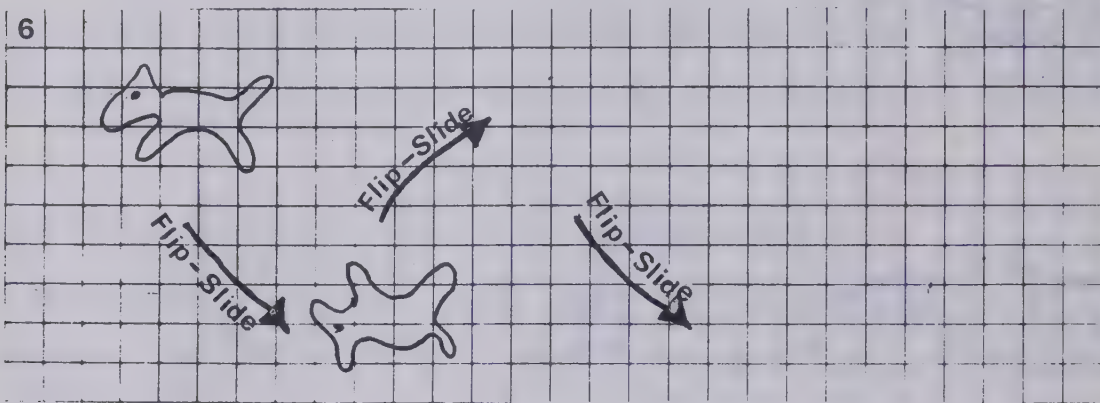
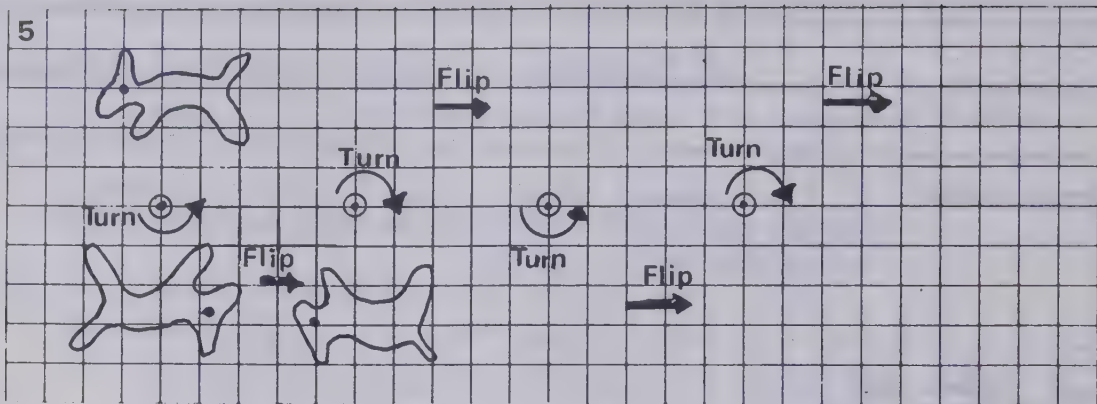
UNIT: VII

OBJECTIVE NO: 23

OBJECTIVE: * Use Motion Geometry to design Wallpaper

SUGGESTED DEVELOPMENT: 1. Use squared paper to make a stencil of some object as shown. Complete the following patterns using the motions shown.





2. Have students design some wallpaper of their own by first making a stencil and then using squared graph paper performing a repeated combination of motions with their stencils to produce a pattern design.

TRAND: GeometryLEVEL: 7NIT: VIIOBJECTIVE NO: 24BJECTIVE: Use Paper Folding to produce stars and regular polygons

MATERIALS: Plain paper, scissors.

SUGGESTED DEVELOPMENT: 1. The purpose of paper geometry is to provide a fresh view of basic geometry and the study of geometric figures while presenting an entertaining and rewarding activity. The concept of symmetry is introduced and used to study the figures made.

2. The Straight Line and Symmetry

A straight line can be made on any piece of paper without instruments.

Simply fold it over and crease the fold.

Try it.

- (a) Fold a piece of paper to produce a straight line. Cut any pattern out and unfold.

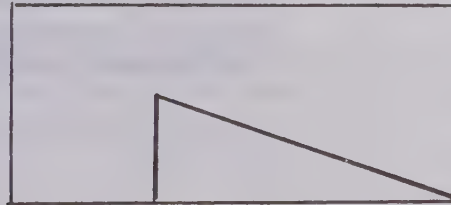


FOLD

NOTE:

For complex folds,
keep folding edge to
left side.

- (b) Fold to make a straight line and cut a triangle from the sheet and unfold. Describe the figures produced. What is the role of the folded straight line?



FOLD

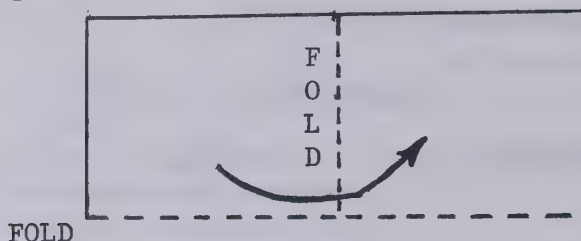
3. Paper Dolls

Fold rectangular piece of paper onto itself.

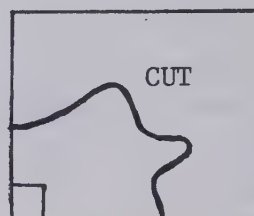
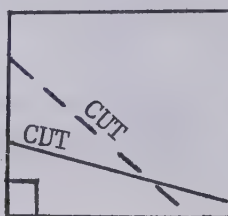
Cut half a doll on fold. Unfold. It may require much experimenting.

4. The Right Angle:

A right angle can be made from two folds, horizontal, and vertical, making sure that edges coincide.



- (a) Fold a right angle and cut the right angle corner off. Do this in several ways. Unfold.
- (b) Fold a right angle and cut any shape off. Unfold.



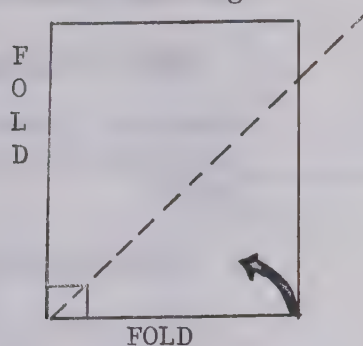
Describe the figures produced. What is the role of the folds? In activity (a), how does cutting in different ways affect the figure?

- (c) Fold a piece of paper twice without making a right angle. Cut the corner off and unfold.

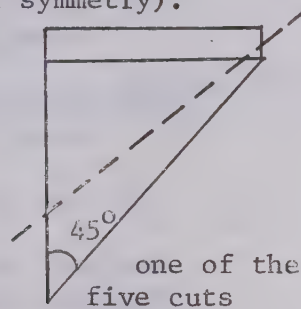
In each of the previous cuts, each fold is an axis of symmetry. Explain the terms symmetry, and symmetrical. Explain axis of symmetry.

5. The 45° Angle:

Fold a right angle. Then fold the corner over to produce a 45° angle.



- (a) Experiment with different straight cuts to cut off the 45° angle. Describe the figures produced (length of sides, number of sides, angles, how many axes of symmetry.) What do all figures produced have in common? (4 lines of symmetry).



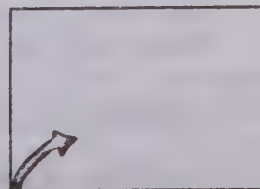
- (b) If you use thin paper (onion skin, or gift wrapping paper) it is possible to fold a 45° angle over to make a $22\frac{1}{9}^\circ$ angle.

Describe the figure produced after cutting off the corner.

- (c) Optional. Intricate designs can be made by making various nicks and cuts. Experiment and design your own.

6. Squares

To make a square, fold over the corner of a rectangle and cut off the uncovered portion. Unfold.



Fold the square to show all its lines of symmetry.

Try some designs based on the square.
eg. Refer to "*Paper Folding for Beginners*"
by Murray and Rigney.

7. Stars and Regular Polygons

You have already discovered how to make squares and 4 pointed stars and octagons and 8 pointed stars.

(a) Pentagons and 5 pointed Stars

- (i) Take a rectangle and fold it in half.
- (ii) Fold the bottom left corner up so that it touches the middle of the top edge.
(To find midpoint of the top edge, fold and pinch).
- (iii) Fold the top left corner down along the edge of the previous fold.
- (iv) Fold the entire object along the lower edge of the fold of step (3).
- (v) Cut the folded corner off and unfold.

Try cuts of various angles.
Describe the figure produced.
Cut a star within a star.
Make your own original design.

(b) Hexagons and 6 pointed Stars.

- (i) Take a rectangle and fold in half.
- (ii) Fold the bottom left corner up and the top left corner down so that the folds come together. Crease. (This fold requires great care).
- (iii) Fold in half.
- (iv) Cut off the folded corner and unfold.

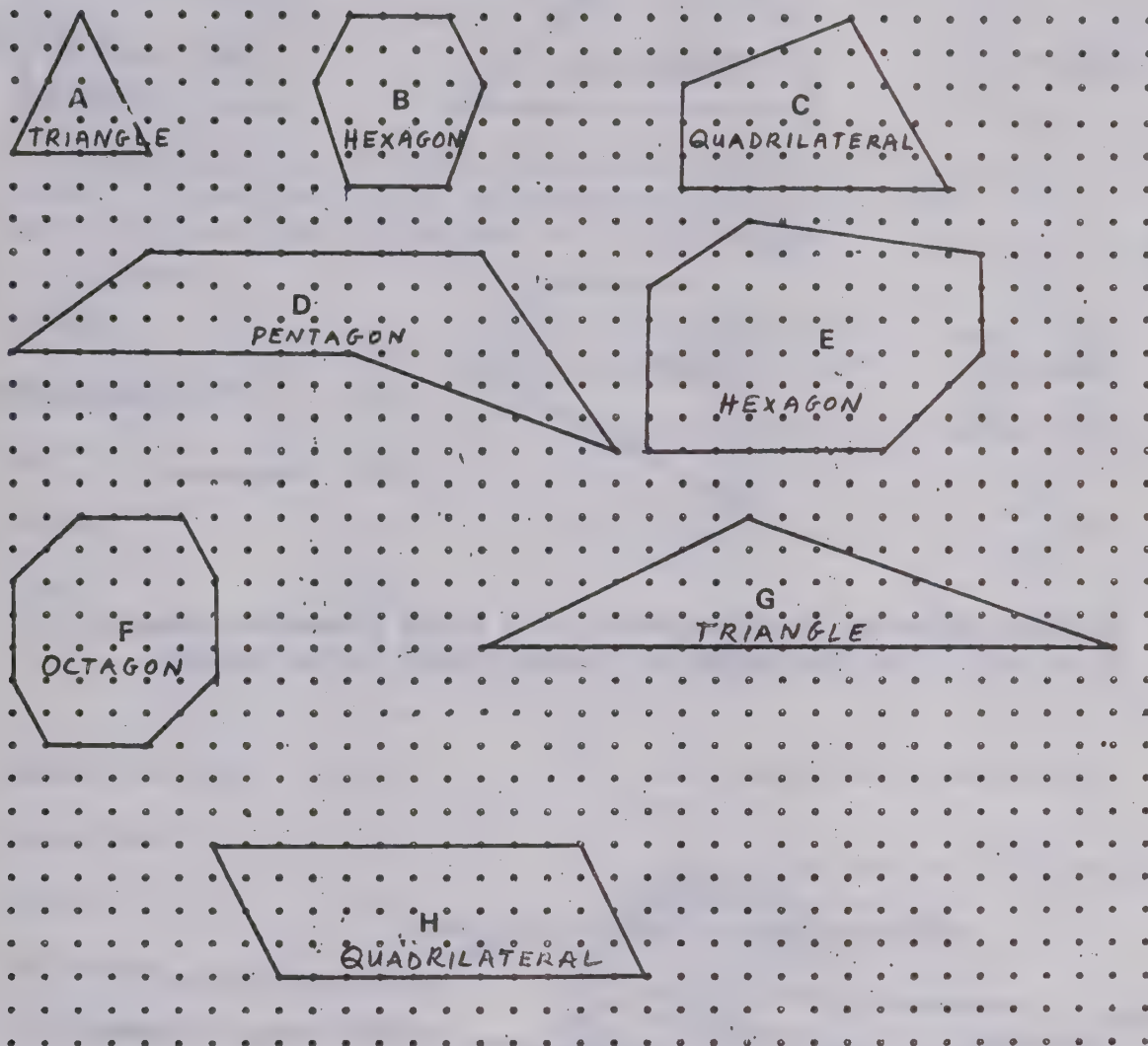
Describe the figure produced.
Try cuts at different angles.
Cut a star within a star.
Make your own original design.

(c) 10 and 12 Pointed Stars

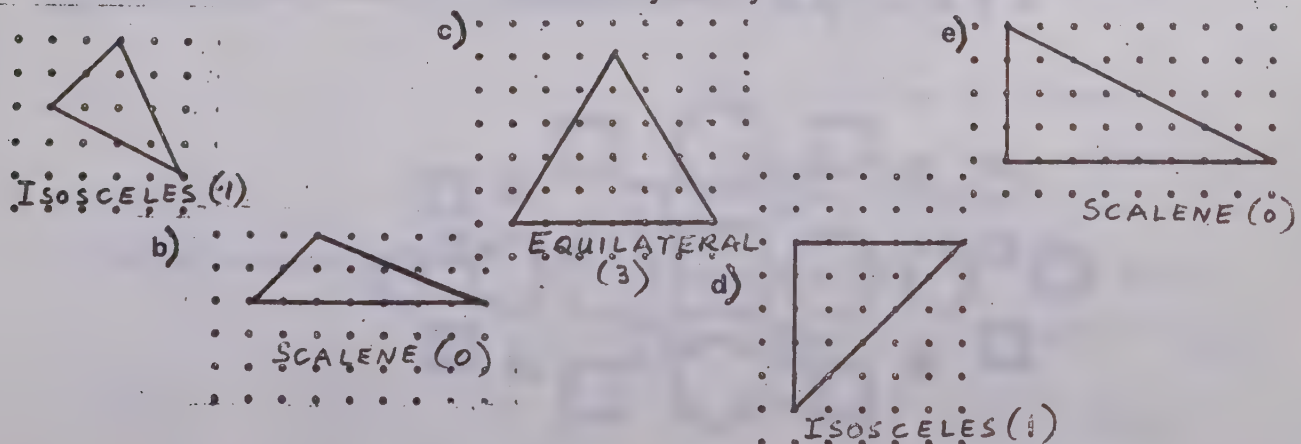
Fold the above in half again.

Now design and fold original masterpieces.

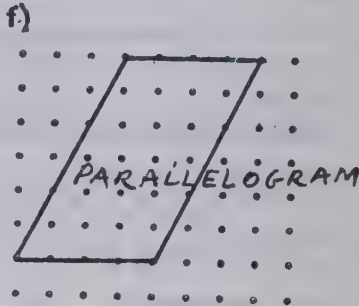
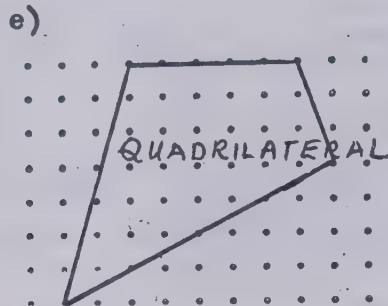
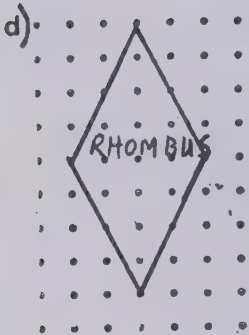
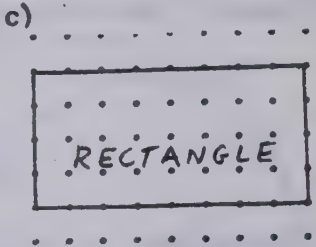
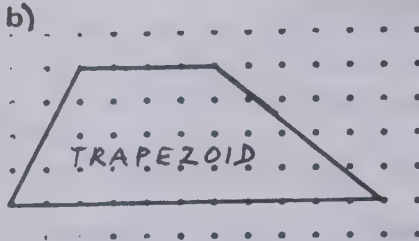
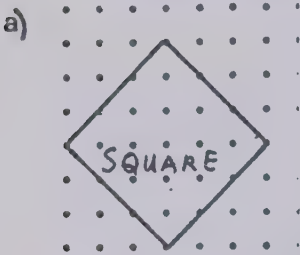
1. Classify the following polygons:



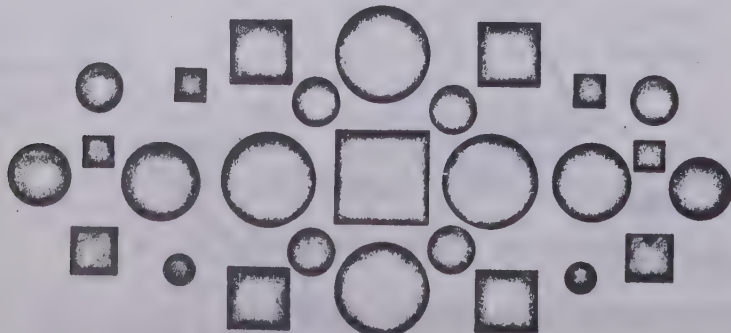
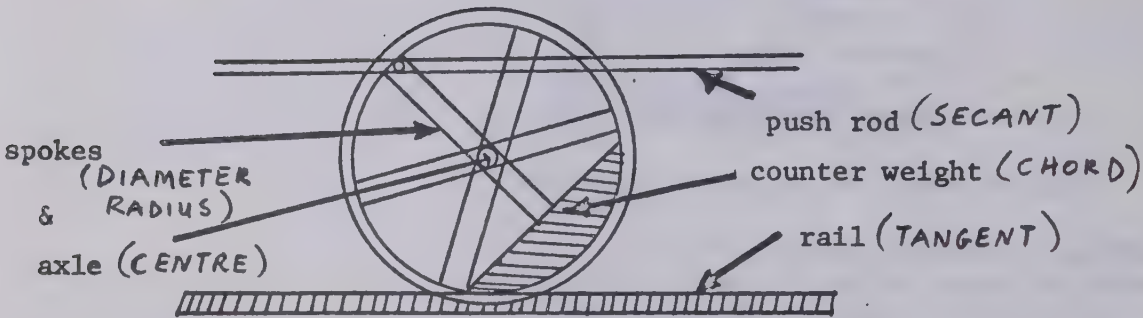
2. Classify each triangle below as isosceles, scalene or equilateral and find the number of lines of symmetry.



3. Classify each quadrilateral below. Give the best name for each.



4. Pictured below is the drive wheel of a steam locomotive standing on a rail. List the parts of a circle shown in the diagram.



UNIT: 1 - 7

LEVEL: 7

SET THEORY1. MATCHING

In your book place the letter of the description at the right, in order. If you have chosen the correct words you will have written a sentence about your achievement on this exercise.

element yuniverse oset usubset rVenn e

e - a diagram which is used to represent sets.

g - a set which has 15 members is .h - $\{0, 1, 2, 3, 4, 5, \dots\}$ is a set.i - $\{0, 10, 20, 50\}$ and $\{50, 0, 20, 10\}$ are .equivalent sets requal sets ifinite ginfinite hodd numbers tn - a set which has no members is the .o - a set which contains all possible elements is the .o - $\{2, 4, 6, 8\}$ r - $\{2, 8, 17\}$ and $\{*, O, \Delta\}$ are .even numbers oempty set n

r - a set which forms part of a larger set.

t - $\{1, 3, 5, 7\}$

u - a collection of things.

y - another name for a member of a specific set.

2. Write in expanded form:

a) $238 \rightarrow (2 \times 100) + (3 \times 10) + (8 \times 1)$

b) $16.1 \rightarrow (1 \times 10) + (6 \times 1) + (1 \times \frac{1}{10})$

c) $4.007 \rightarrow (4 \times 1) + (7 \times \frac{1}{1000})$

d) $260.04 \rightarrow (2 \times 100) + (6 \times 10) + (4 \times \frac{1}{100})$

3. Write in standard form: a) $3 \times 100 + 5 \times 10 + 6 \times 1 \rightarrow 356$

b) $2 \times 10 + 5 \times \frac{1}{10} \rightarrow 20.5$

c) $1 \times 1\,000 + 9 \times 1 + 3 \times \frac{1}{100} + 4 \times \frac{1}{1\,000} \rightarrow 1000.0034$

d) $2 \times 10 + 5 \times 1 + 7 \times \frac{1}{100} + 8 \times \frac{1}{10\,000} \rightarrow 25.0078$

4. Find the G.C.F. of : a) 3, 4, 6 (1) c) 12, 28, 34 (2)

b) 40, 80, 120 (40) d) 36, 60, 120 (12)

5. ADDITION:

a)
$$\begin{array}{r} 237 \\ 691 \\ 13 \\ 272 \\ \hline 1213 \end{array}$$

b)
$$\begin{array}{r} 26.01 \\ 1.45 \\ 23.95 \\ \hline 51.41 \end{array}$$

c) $\frac{2}{3} + 1\frac{1}{3} = 2$

d) $\frac{5}{16} + \frac{1}{8} = \frac{7}{16}$

e) $5\frac{1}{2} + 2\frac{2}{3} = 8\frac{1}{6}$

f) $1.61 + 26.4 + 30.02 = 58.03$

6. SUBTRACTION:

a)
$$\begin{array}{r} 2061 \\ -158 \\ \hline 1903 \end{array}$$

b)
$$\begin{array}{r} 13.040 \\ -6.217 \\ \hline 6.823 \end{array}$$

c) $238 - 16.93 = 221.07$

d) $1268.46 - 93 = 1175.46$

e) $\frac{7}{8} - \frac{1}{2} = \frac{3}{8}$

f) $1\frac{1}{3} - \frac{4}{5} = \frac{8}{15}$

g) $3\frac{2}{3} - 1\frac{1}{2} = 2\frac{1}{6}$

7. MULTIPLICATION:

a)
$$\begin{array}{r} 273 \\ \times 19 \\ \hline 5187 \end{array}$$

b)
$$\begin{array}{r} 16.04 \\ \times 3.1 \\ \hline 49.724 \end{array}$$

c)
$$\begin{array}{r} 168 \\ \times 7.11 \\ \hline 1194.48 \end{array}$$

d) $\frac{3}{4} \times \frac{8}{15} = \frac{2}{5}$

e) $2\frac{1}{4} \times \frac{1}{9} = \frac{1}{4}$

f) $3\frac{1}{5} \times 4\frac{1}{16} = 13$

g) $3 \times 2\frac{1}{3} = 7$

8. DIVISION:

a) $16 \overline{) 256} \begin{array}{l} 16 \\ 256 \end{array}$

b) $13.1 \overline{) 6.55} \begin{array}{l} 5 \\ 6.55 \end{array}$

c) $20.7 \overline{) 621} \begin{array}{l} 30 \\ 621 \end{array}$

d) $\frac{1}{3} + \frac{4}{5} = \frac{5}{12}$

e) $3\frac{1}{4} \div \frac{13}{15} = 3\frac{3}{4}$

f) $2\frac{1}{2} \div 4 = \frac{5}{8}$

g) $3\frac{1}{3} \div 2\frac{5}{6} = 1\frac{3}{17}$

9. EVALUATE:

a) $3 \times 4 + 70 \div 2 = 47$

b) $\frac{1}{2}(\frac{3}{4} + \frac{5}{8}) = \frac{11}{16}$

c) $2.01 + 3.08 \times 2 - 4.5 = 3.67$

10. SOLVING CONDITIONS:

$x = 3\frac{1}{4}$

a) $x + 7 = 12$

b) $x - \frac{3}{4} = 2\frac{1}{2}$

c) $4.6x = 18.4$

$x = 5$

d) $\frac{x}{3.1} = 4.5$

$x = 4$

$x = 13.95$

11. MAKE EQUIVALENT FRACTIONS:

$\frac{1}{5} = \frac{x}{100} (20)$

$\frac{3}{8} = \frac{s}{100} (37.5)$

$\frac{3}{t} = \frac{12}{18} (4.5)$

$\frac{3}{16} = \frac{9}{a} (48)$

12. MEASUREMENT:

Express in the indicated unit:

a) 18.6 m (cm, km)
(1860, .0186)

b) 238 cm (m, mm)
(2.38, 2380)

c) $19.05 \text{ dam (m, mm)}$
(190.5, 190500)

13. Answer in Given Units:

a) $124 \text{ mm} + 14 \text{ cm} + 2 \text{ m} = (\text{cm}) 226.4 \text{ cm}$

b) $11\,238 \text{ m} - 1.9 \text{ km} + 3.6 \text{ dam} = (\text{m}) 9374 \text{ m}$

14. EXPONENTS:

$3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$

a) What is the base? 3

b) What is the exponent? 5

15. CALCULATE:

a) $2^6 = 64$

b) $5^2 = 25$

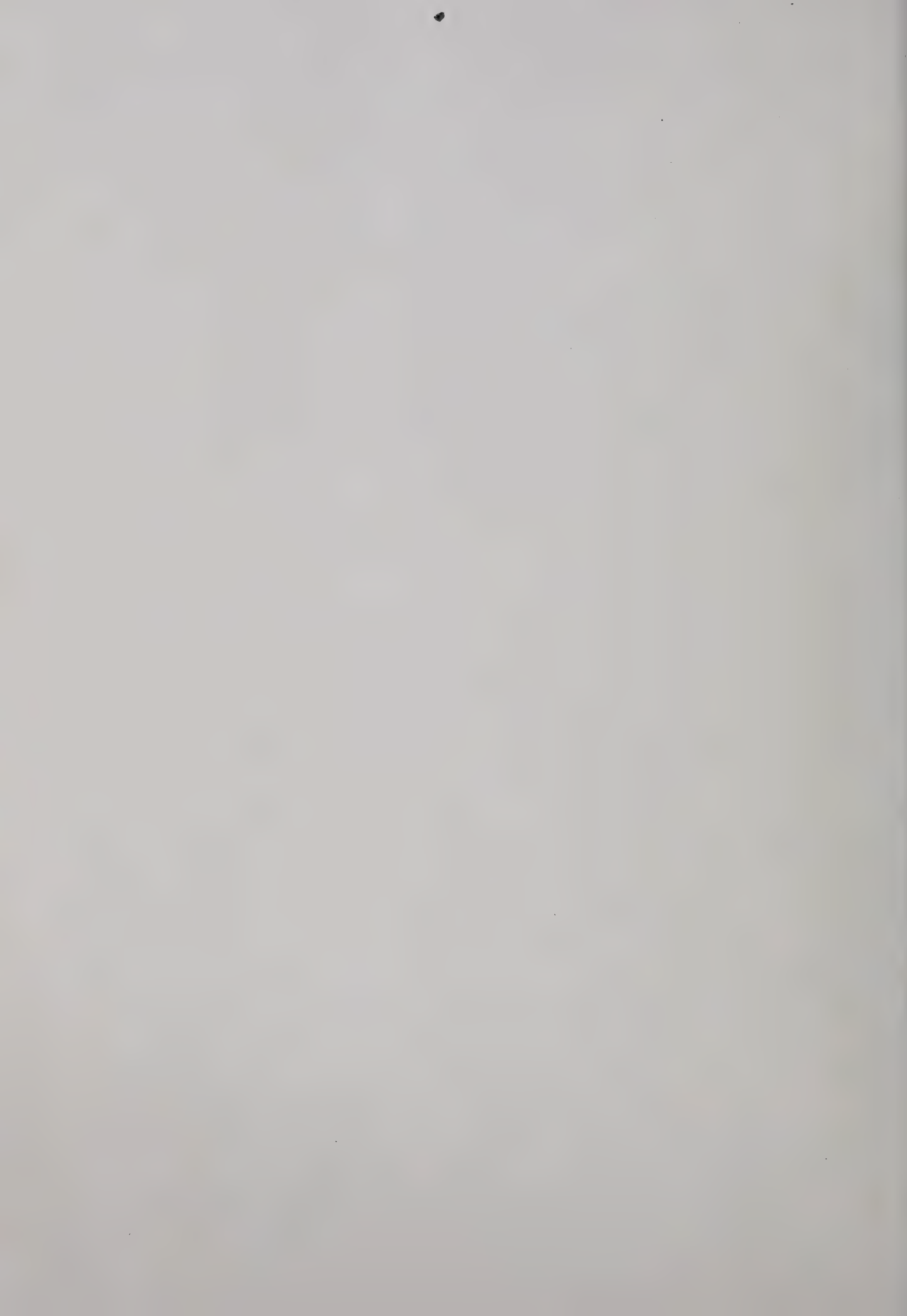
c) $1.8^2 = 3.24$

d) $(\frac{1}{3})^4 = \frac{1}{81}$



[illegible]

F. 255





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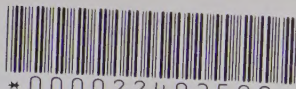
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